March, 1944

THE FOUNDRY

FIFTY-SECOND YEAR

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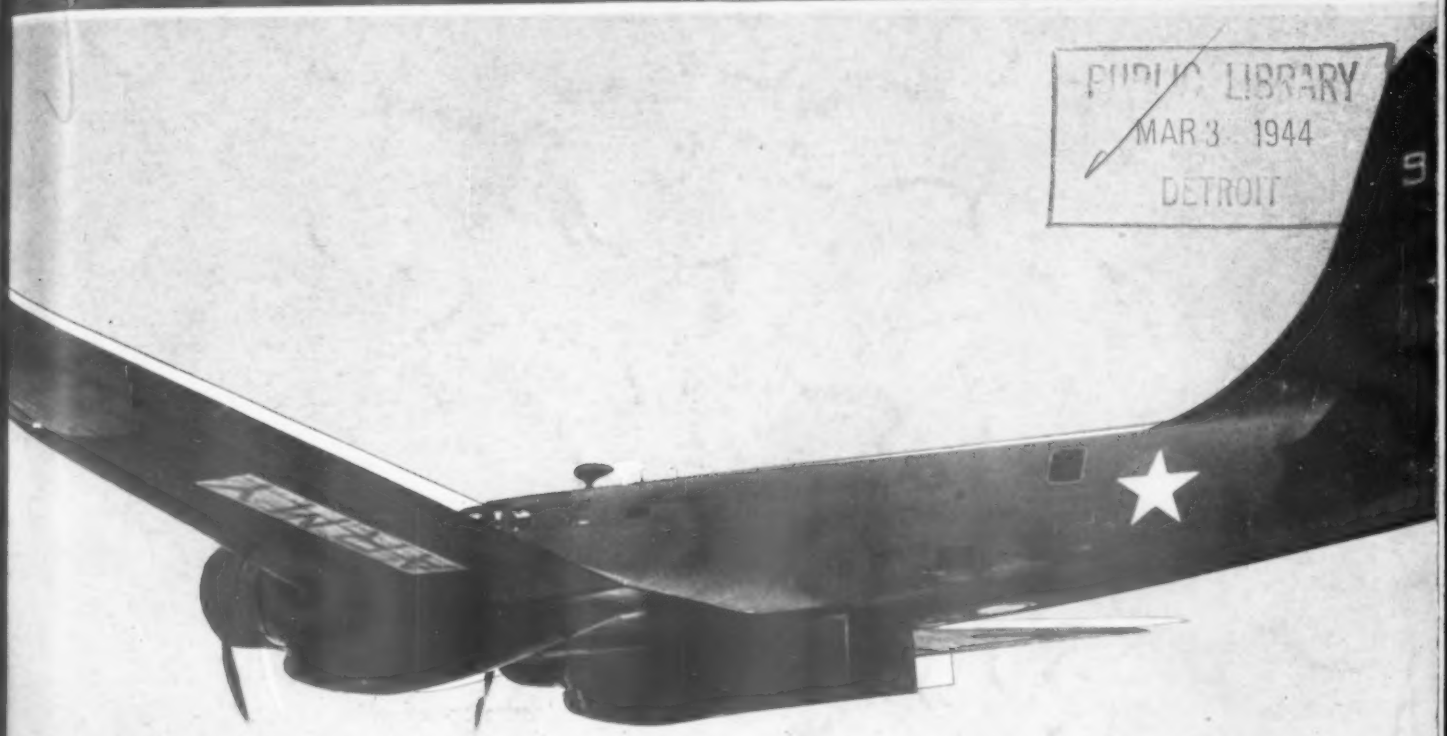
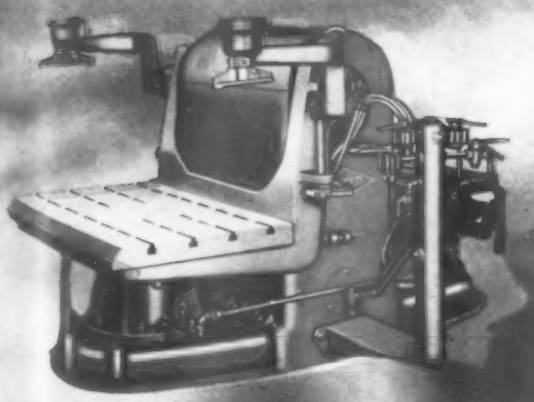


Flying Castings

This remarkable photograph was taken by the U. S. Army photographers. It shows a 2,000 pound bomb an instant after it was released from a two-motored bomber above the Ordnance Department's Proving Ground at Aberdeen, Maryland. This cast metal bomb is filled with high explosives.

Bomb castings are only one of the thousands of products of American foundries using modern molding machine methods that have helped contribute to universal democracy.

Check your molding equipment today. See that your foundry is using every possible economy in your molding machine department. Let us send you our latest catalog.



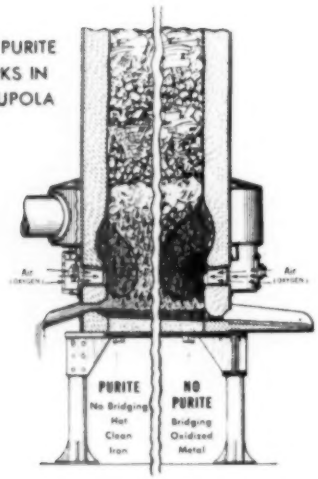
JOLT ROLLOVER DRAW, No. 34, MODEL A

DAVENPORT MACHINE & FOUNDRY CO.

DAVENPORT IOWA U. S. A.

SPEED PRODUCTION OF SOUNDER CASTINGS

HOW PURITE WORKS IN THE CUPOLA



PURITE keeps the tuyeres open and bright during long heats and prevents bridging — gives a clean drop at the finish.

PURITE restricts the combustion zone to a smaller, hotter area in front of the tuyeres — prevents oxidation of the metal charge.

To insure sounder, better machining castings, use Purite. Refining with Purite, either in the cupola or in a mixer ladle, removes inclusions, desulphurizes and helps to prevent losses due to segregation of impurities.

Purite increases the fluidity and activity of the slag, speeds up combustion and reduces oxidation of the metal.

Purite pays real dividends in better cupola operations and cleaner, better casting metal.

THE SCIENTIFIC FLUX FOR BETTER MELTING AND CLEANER IRON

PURITE

THE MATHIESON ALKALI WORKS (INC.)
60 EAST 42nd STREET, NEW YORK 17, N. Y.
(Licensee of Metallurgical Development Company, Inc.)

★ *Production for them and their brothers in service* ★

THE BENTONITE

STRENGTH...SPEED...UNIFORMITY

STRONG—Green Bond is strong. Careful selection and pre-testing of deposits—laboratory control of every processing step guarantees its strength when it reaches the foundry.

FAST—Green Bond is fast. It blends with sand so quickly that it's the ideal bentonite for use in today's high-speed mullers. Uniform grind makes it fast. For real speed, it's Federal Green Bond.

UNIFORM—You can establish your batch-mix with Green Bond permanently. Careful selection and processing by us ensure a constant, never-changing mix to you.

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THE FOUNDRY

for MARCH 1944

VOLUME 72 NUMBER 3

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London . . . . . 2, Caxton Street, Westminster, S.W. 1.

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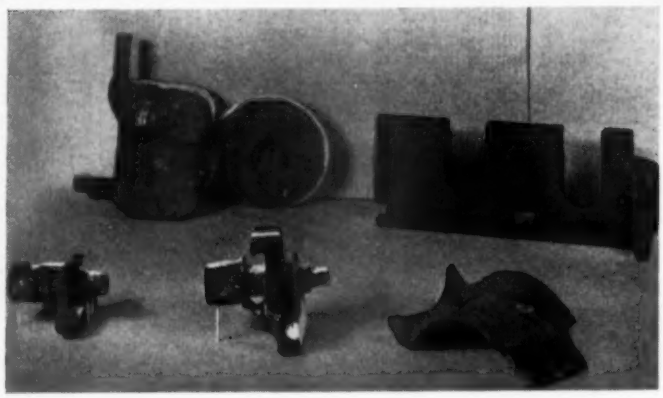
	Page
Editorial	97
Casting in Plaster Molds By FRED CHAMBERS	98
Molds Laundry Machinery Castings By PAT DWYER	100
Structure Control of Gray Cast Iron By R. G. McELWEE and TOM E. BARLOW	104
Selecting, Evaluating and Specifying Metallic Materials By H. W. GILLETT	106
Makes the Most of Floor Space By PAT DWYER	107
Heat Treating Bronze Castings By J. W. HORNER and FRANK A. MASON	109
A.F.A. Plans Foundry Congress to Aid War Production	110
Rapid Determination of Chromium, Nickel and Manganese By R. H. JACOBY	111
Utilizing Alloy Steel Scrap By VICTOR E. ZANG	113
Factors in the Production of Quality Castings By WILLIAM G. REICHERT	114
Steel Founders Face Sustained War Demands By WILLIAM G. GUDE	129
The Adventures of Bill By PAT DWYER	136
Among Detroit Foundries By A. H. ALLEN	140
Wisconsin Conference Covers Wide Range of Topics By PAT DWYER and EDWIN BREMER	144
Time Cycle for Procuring Magnesium Castings	160

Questions and Answers	116	Obituary	164
Men of Industry	122	Foundry Developments	177
Foundry Group Meetings	152	Foundry Activities	182
Equipment and Supplies	159	New Trade Publications	196
Washington Notes	161	Where-to-Buy Directory	198

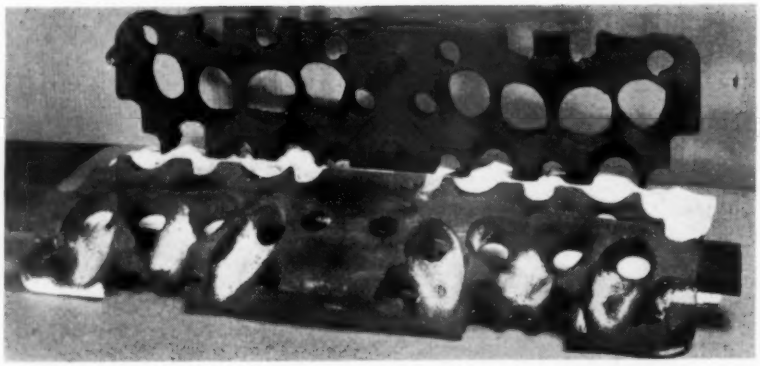
Index to Advertisers 238

one ounce or one ton



PLYMOUTH LOCOMOTIVE
THE FATE-ROOT-

Twenty-five Years Experience with Linoil Has What it Takes to Make Cas

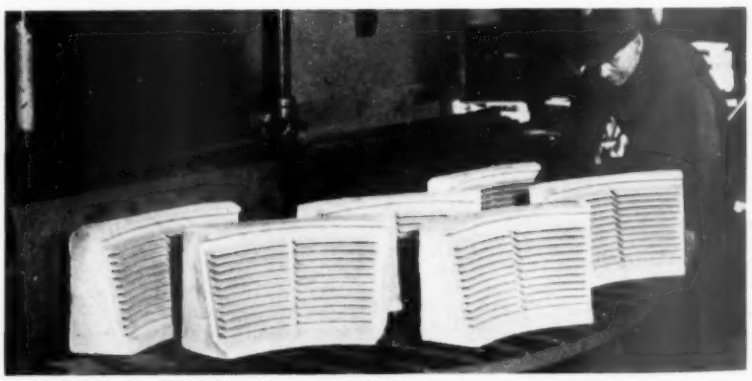


Watch carefully the tempering of your core sand. Moisture content affects oven time, oil ratio, and core strength.

If sand or oil are used too cold do not add more oil, but mix or mull longer.

Watch out for clay, loam, or for unwanted fines in your core sand —they are bad trouble-makers.

Gasoline and diesel locomotives, clay-working machinery, and tractors are the chief products of this Plymouth, Ohio, foundry where Linoil has been the standby for more than a quarter-century. Core makers, molders and management know Linoil from A to Z and swear by it. Old and satisfied customers such as this are good proof of merit. It takes an efficient product, an economical product, and above all in core oil, a uniform product to stand the test of time. Linoil has a long record of absolute uniformity; Linoil, too, has a long record of efficiency and economy in foundry work. Linoil is for any foundryman to use who demands stable, dependable cores year in and year out at lowest core cost. Safe and easy to use, order today.



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(DIVISION OF ARCHER-

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it pays to use LINOIL

WORKS OF HEATH COMPANY

Linoil Convinces this Foundry that Castings Dependably & Economically

LINOIL

THE LOGICAL OIL FOR CORES

Strength to stand handling—handling in emptying the ovens, in inspection, in storage, in transporting to molders, in assembling the molds.

Strength to withstand the heat, the weight and pressure of molten metal, and the erosive effect of pour and flow until the metal has set.

And then—at just the right moment — collapsibility, complete giving way of strength and resistance, crumbling of the core so that no resistance is offered even to thin sections in the cooling and contracting casting.

SMITH COMPANY

DANIELS - MIDLAND COMPANY)

4690 CLEVELAND 2, OHIO

NEWS FLASH!

700 BLAST

• AN ORDER
ONE CUSTOMER
LARGEST SINGLE

ROTOBLAST

means faster cleaning of castings, forgings, stampings, heat-treated parts, etc. Faster removal of sand and scale—with the cleaned surfaces in perfect condition for faster machining, grinding and metallizing.

ROTOBLAST means substantial blast equipment expertly designed for faster production of all sizes and shapes of work. BARRELS in five standard drum capacities. From 3½ minimum to 28 cubic feet maximum. Holds all miscellaneous foundry work of average type. TABLES—both single and multi-spindle, for flat or fragile pieces. SPECIAL MACHINES for automatic cleaning of continuous

*Trade mark of Pangborn Corporation for airless blast cleaning

WORLD'S LARGEST MANUFACTURER OF BLAST

ARMY E NAVY

PANG

PANGBORN CORPORATION . . . . . .

CLEANING MACHINES!

FOR 700 BLAST CLEANING MACHINES FROM HAS JUST BEEN RECEIVED BY PANGBORN—THE ORDER IN THE HISTORY OF THE INDUSTRY.

work such as cylinder blocks and heads, chair backs, large axles, tank parts, etc.

ROTOBLAST machines are sturdy. They are built for hard service. For long hours of production.

"ROTOBLASTING" is economical. When cleaning time is cut 3 or 4 hours per day—when one man finishes in half a shift what five men formerly did in their full time—when power and labor and wear are all reduced to a fraction of their previous cost—that's economy. ROTOBLAST economy. The kind users get when they COME TO

"PANGBORN"

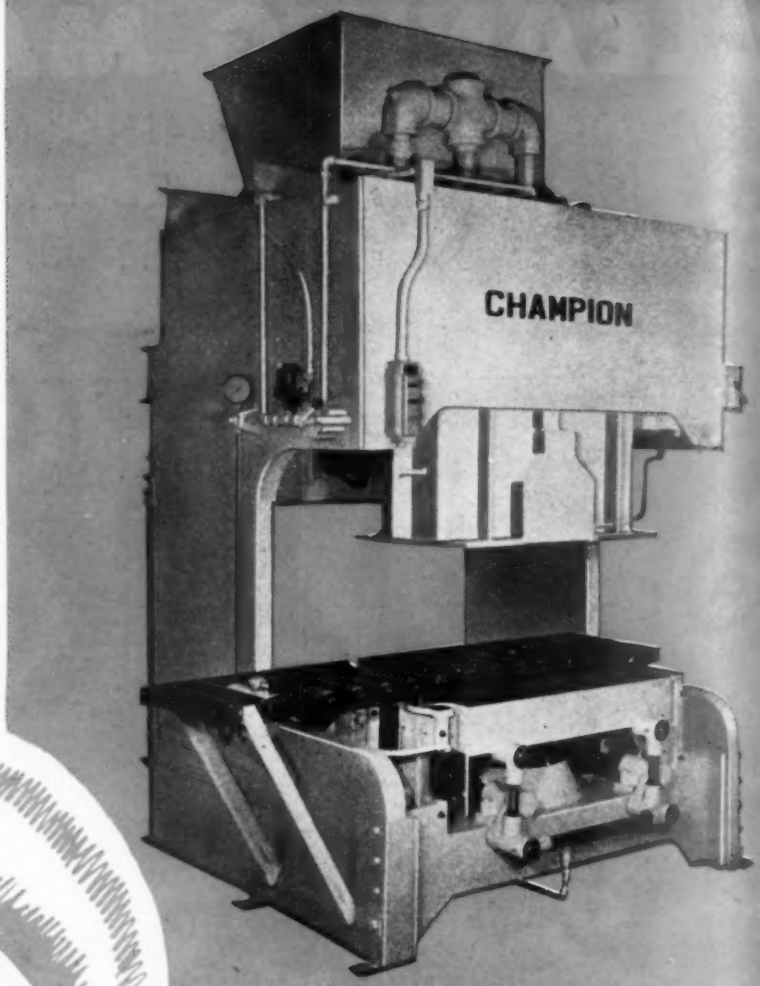
CLEANING AND DUST CONTROL EQUIPMENT

PANGBORN

ARMY E NAVY

HAGERSTOWN, MARYLAND

Champion core blowers



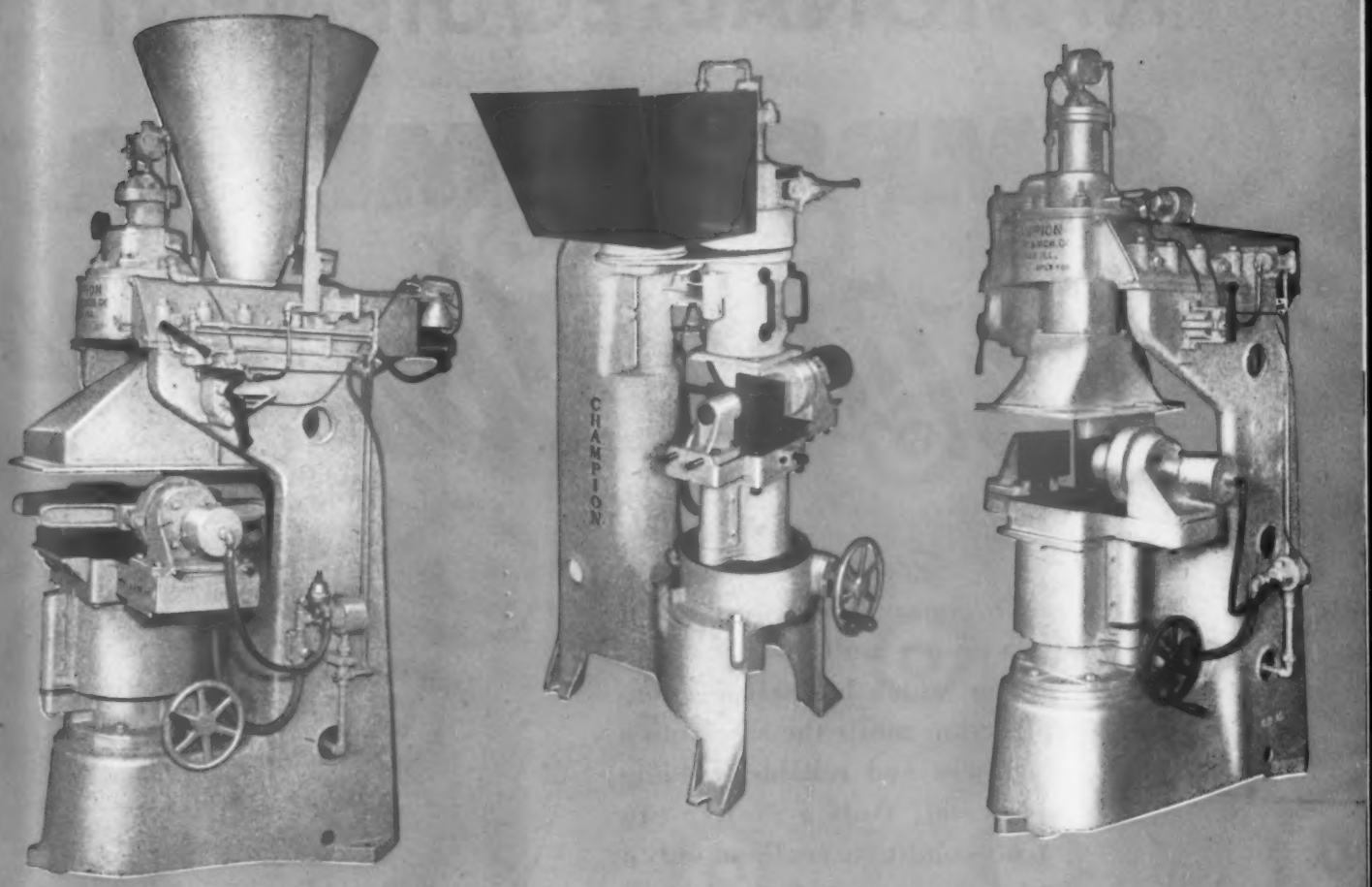
CHAMPION MODEL CB-400

25% more blow power is delivered by Champion Core Blowers because of instantaneous blow valve action which decreases air leakage and prevents pressure dissipation. And superior power from a minimum of effort is the hallmark of a Champion in the air, on the sea or in a lonely foxhole. There is no bending, stooping or reaching when you produce your cores with a Champion Core Blower. Each model is designed in every detail to ease the burden of labor and operate with a minimum of fatigue.

Land the Knock-out Punch on Core Problems

We'll gladly tell you where

CHAMPION



CHAMPION MODEL CB-15 CHAMPION MODEL CB-8 CHAMPION MODEL CB-12

The working table is completely accessible with no obstructions, so that cores are produced faster, more economically and more accurately without need for highly trained labor.

A single valve operates the core box clamp, clamps same against the blow plate, blows the core, exhausts and releases the clamps in the proper cycle. Rigid one-piece, cast steel frame insures accurate alignment of core box and blow plate. Patented Air-Operated Hydraulic Clamp locks the core box securely against split box separation.

Any man or woman can produce perfectly rammed cores on a Champion Core Blower by merely setting the box and pulling the lever. In a single second small or large cores are perfectly rammed.

Today, Champions are doing their part to hurry America's war effort. Tomorrow, those same Champions will continue to earn greater profits for their owners through faster, more accurate, more economical production of cores.

Champions may be seen in action on your kind of work

Foundry & Machine Co.

1318 W. 21st St.
Chicago, Illinois

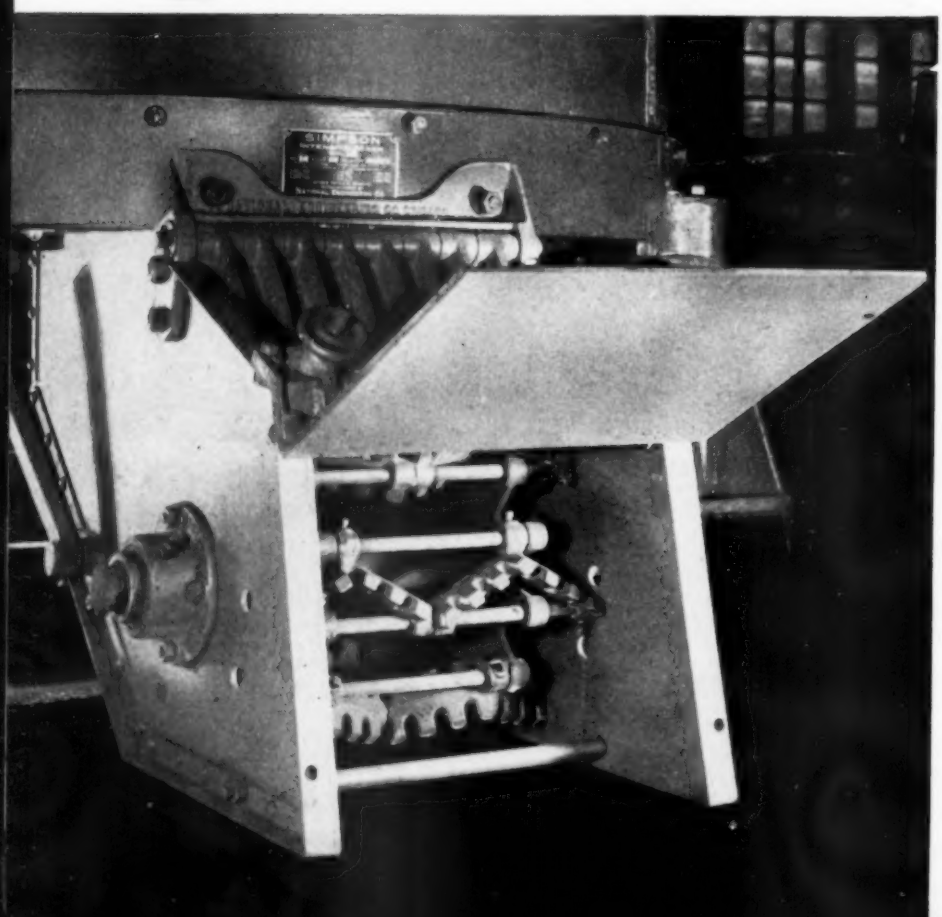
NATIONAL EQUIPMENT . .

SIMPSON MIXERS

plus

National Aerators

First and foremost **in every sand control problem is a proper muller—a Simpson Mixer, which by exclusive construction mulls the sand into a uniform and reliable molding material. Only a muller can truly condition sand and only a Simpson can satisfactorily mull the many classifications of sands now used in up-to-date foundry practice.**



The Simpson Mixer **has the exclusive feature of utilizing an aerator if necessary; that is, it can be used or not as desired. The National Aerator operates at a speed which does not strip the bond from the sand grain which would defeat the result that the muller has accomplished. Generally there are two types of mechanical aerators—those which gently comb and fluff the sand, eliminating the necessity of riddling the sand against the patterns, and those which violently throw the sand. The first is the Simpson method—long accepted by practical foundrymen as achieving a true aeration through opening of the sand mass without segregation of bond and binder.**

. . for Better Sand Control

to properly mull and then thoroughly aerate sand

Features of the National Aerator Are:

Operating at a reduced speed the thoroughly prepared sand is received from the Simpson Mixer discharge into the combing fingers, which easily and quickly fluff the mulled sand without destroying the true mulling accomplished by the Simpson Mixer.

National Aerators are purposely separate machines from the Simpson Mixers for in our study of molding technique we found that aeration and mulling are opposite actions and must be treated in turn and not simultaneously.

National Aerators have the further exclusive feature of being the only equipment of its type which can be directly attached to the discharge of a sand mixer, making the two machines an integral unit and yet properly separating the functions.

, National Aerators consist of a drum shaft mounted on sealed, self-aligning, anti-friction bearings. The combing bars are reversible and thereby provide double-life wear. Also there is an automatic cleanout handle provided in order that the machine may be cleaned without direct contact with rotating parts.

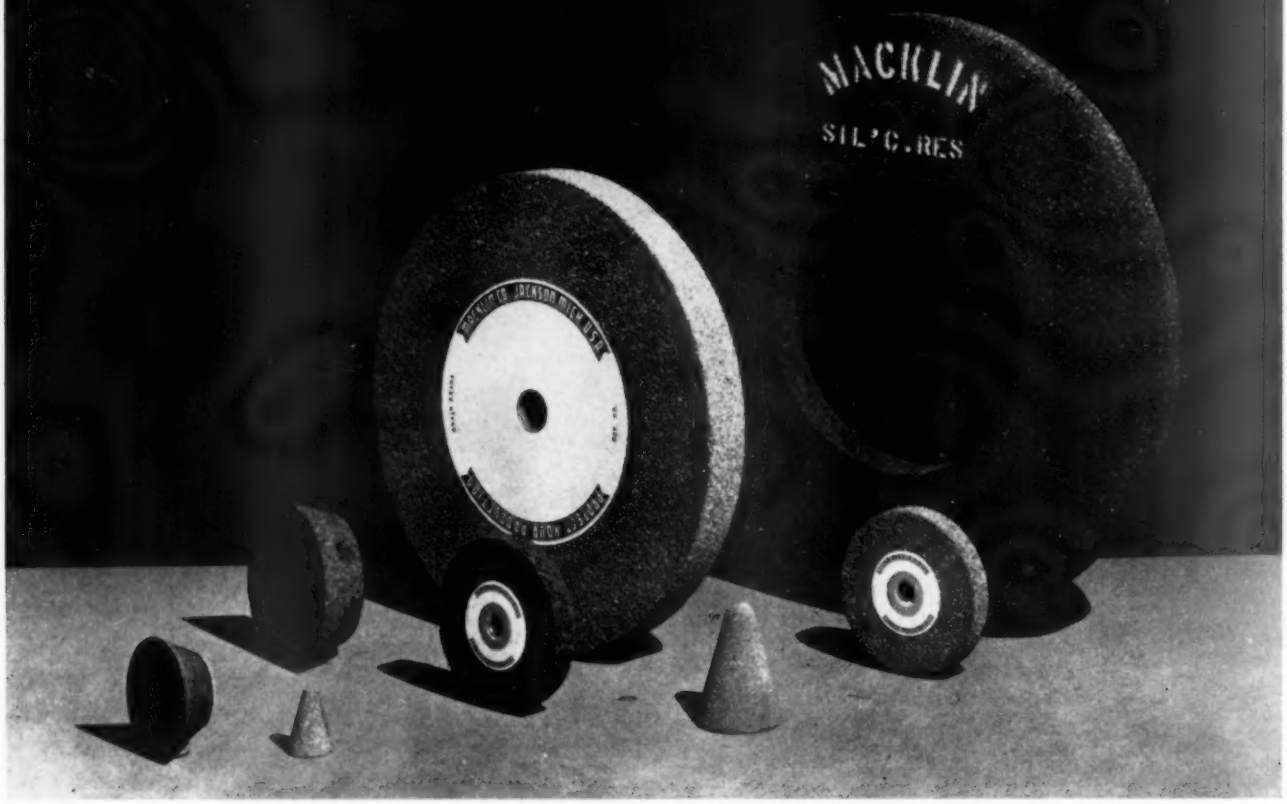
Use National Aerators for increasing flowability of your Simpson mulled sand.

National Engineering Service **National Field Service**

For more than 30 years National Engineering and Field Service, has helped hundreds of foundries solve problems in sand preparation, reclamation, handling, storage and control. Today, National Engineers are constantly on the job helping foundries with problems of sand handling and control on construction, maintenance, repair or new requirements. National Engineering and Field Service is available and eager to help you whenever and wherever you need it.

Manufacturers and Selling Agents for Continental European Countries: —The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia — August's Limited, Halifax, England. For Canada — Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand — Gibson, Battle & Co., Pty., Ltd. Sydney, Australia

MACKLIN GRINDING WHEELS



FOUNDRIES, large and small, require grinding wheels in many sizes, shape, grains and grade combinations.

Macklin Company is thoroughly equipped to produce high quality grinding wheels for all foundry requirements.

No matter what your grinding problems may be there is a Macklin wheel to fit the job that will "Protect Your Production."

Ask for the services of a Macklin Field Engineer.

Invest in War Bonds

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS—JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

***Sales Offices:*—Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia**

Royer Model "D" portable sand conditioner with a capacity of 20 to 30 tons per hour at the Stiglitz Furnace & Foundry Co., Louisville, Ky.

Only a Royer Meets All Requirements!

Stiglitz Furnace & Foundry Co., Louisville, Ky., makers of the well known Victory stoves as well as armament castings, feeds its Royer Sand Conditioner in the manner pictured below instead of shoveling into the hopper. The Royer is the only sand preparation unit into which a whole wheelbarrow load of sand can be dumped without choking the feed. And yet, the sand discharged is properly conditioned.

Most portable sand conditioning equipment merely screens and throws, but the Royer's "Six Point" Sand Conditioning provides molding, facing, backing or core sand at its best. The action of the Royer's combing belt assures complete blending and mixing, positive lump breaking, thorough refuse removal, even distribution of moisture and increased permeability. The sand is aerated twice —once on the belt and again on the discharge. That's why over 5,500 Royers are in use today. Write for catalog.

"Sonny" knows this much about sand—he has learned how much water his sand should contain if his castles and other fantastic structures are to stand up.
In the foundry, Royer "Six Point" Sand Conditioning is essential.

THE ROYER FOUNDRY & MACHINE CO.
KINGSTON, PENNSYLVANIA

FOREMOST IN SAND CONDITIONING EQUIPMENT

How We Keep Perfect Control of Ingot Specifications

The curve chart above, calculates the exact quantity of every element in a Michigan Smelting non-ferrous alloy. It is plotted from data supplied by a Spectrogram as read on the Densitometer in our laboratories. This quantitative analysis is made from a sample drawn from the furnace charge, taken while the metal is still molten—speeded to the Spectrograph where the spectral lines are photographed. Thus, before a single ingot is poured, we can determine and make certain, that the alloy in question meets every specification requirement—is made exactly as ordered

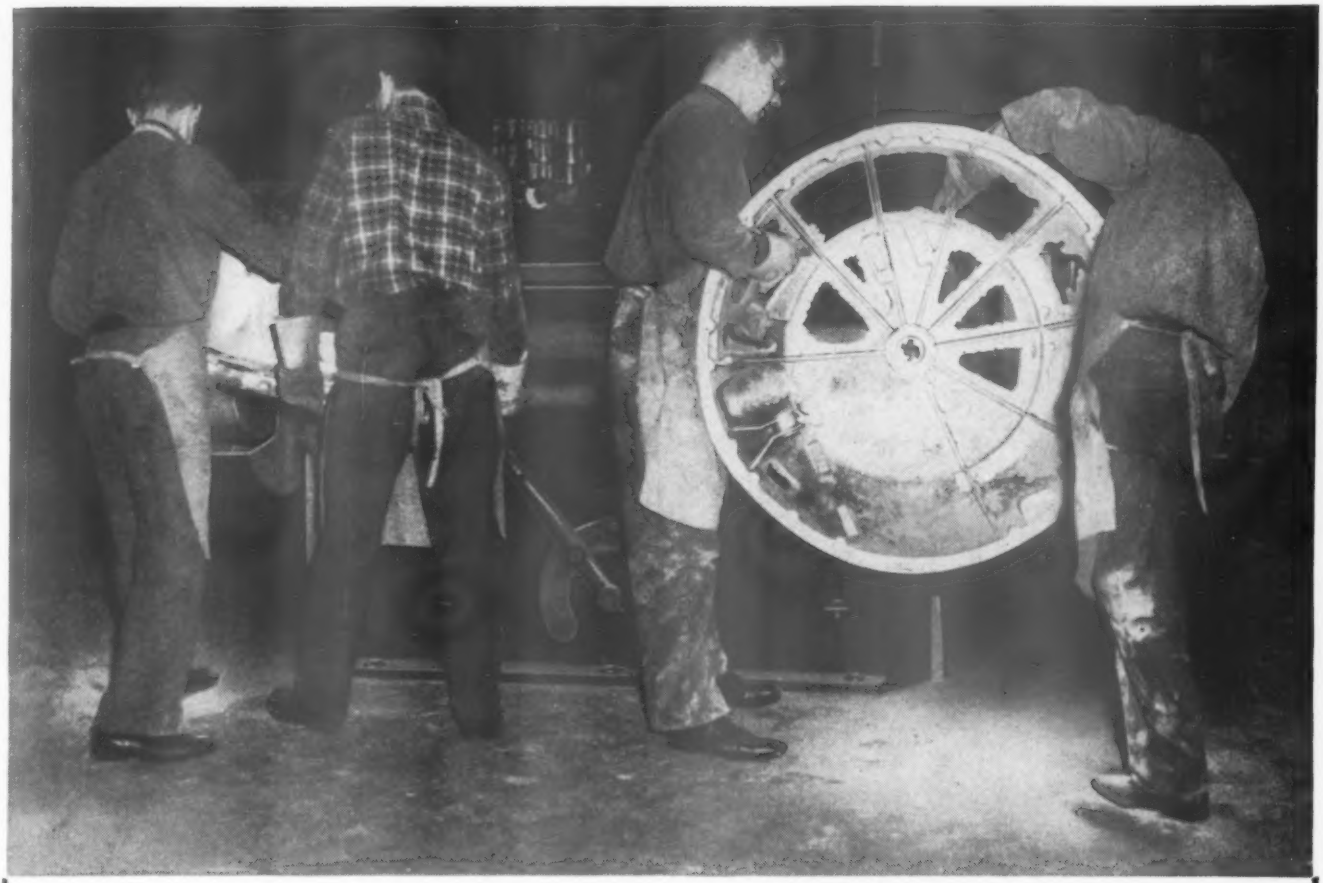
BUY WAR BONDS

MICHIGAN SMELTING and Refining

Division of

BOHN ALUMINUM & BRASS CORPORATION · Detroit, Michigan

General Offices: Lafayette Building



AT LAST...

the Answer to heavy duty snagging grinding

FULL 30 H. P. ADJUSTABLE SPEED HEAVY DUTY SNAGGING GRINDER

for heaviest production grinding when more power is needed than on the average production job

speed change in just a few seconds

available in a variety of spindle speeds according to the type of grinding desired

MODEL 69 IS N-E-W! Built for heavy-duty demands and continuous service. A burly grinder to stand up under present day exacting requirements. Equipped with four-speed gear drive transmission; totally enclosed FULL 30 H.P. N.E.M.A. MOTOR, fan cooled; semi-enclosed constantly lubricated gears; speed lever interlocked with guards which makes it impossible to increase speed unless wheels are worn down sufficiently to allow a speed change; wheel lock on motor to prevent back-lash when changing gears; boiler plate adjustable wheel guards; tool rests; push button control; electric interlock prevents operation unless gears are in mesh. Also available with 40 H.P. motor.

Write for information. Reasonably prompt deliveries.

The UNITED STATES ELECTRICAL TOOL Co.
CINCINNATI, OHIO

PARASPRAY

CORE-MOLD COATING

A POSITIVE *MUST* IN YOUR POST-WAR FOUNDRY PLANNING

TODAY Paraspay is a MUST in some of the world's largest foundries because of its phenomenal record in speeding up production of vital war castings . . . cutting scrap losses to a negligible percentage by eliminating porosity . . . improving quality of castings . . . Paraspray's war record is one we are proud to compare with that of American Industry as a whole.

READ WHAT THREE OF THE WORLD'S LARGEST FOUNDERS SAY

"Our experience shows us that we save in man power about 72 men per 1,000 heads cast and $1.182 per head."

"Welds in Rocker boxes have dropped to less than 2% and leaks in the same area on water test at 60 lbs. pressure to less than 3/10%."

"Effect an 8% saving in time and space in core making . . . Reduction of 25% in labor in melting and pouring unit . . . Has resulted in general improved quality."

WHEN Peace comes . . . and it's coming fast . . . when foundries are reconverting to the needs of consumer goods . . . the speed and economy which our Para Products have contributed to the elimination of Dictators will be vital factors in the overcoming of less progressive competition.

Sole licensees under the Saeger Patents exclusively regulating the use of rubber compounds in making and spraying cores and molds.

PARASPRAY CORES MOLDS

PARASET CORE BINDER

PARACOAT FOR PATTERNS

FOUNDRY RUBBER COMPOUNDS CORP.

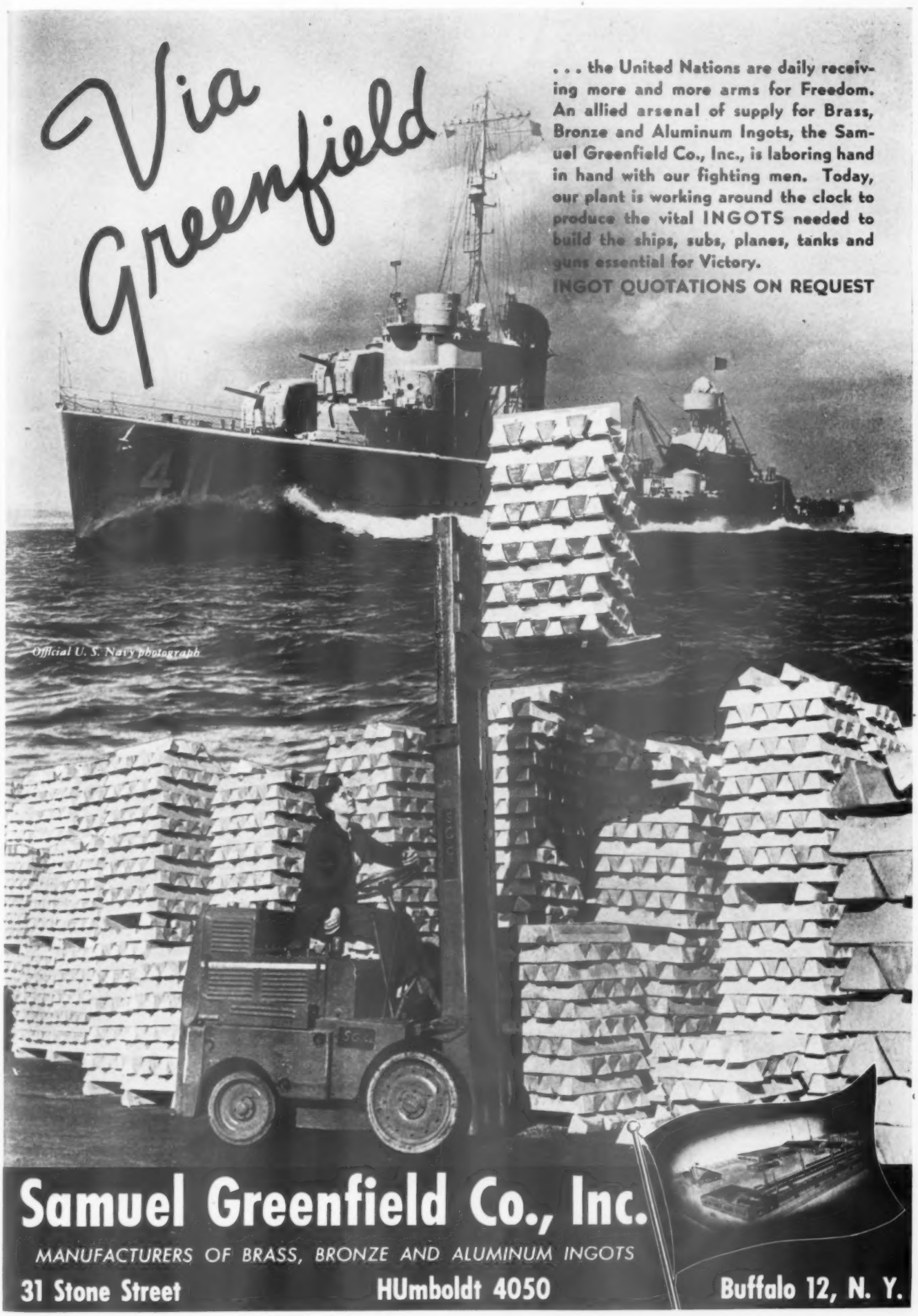
1050 - 30th ST., N. W. WASHINGTON 7, D. C.

COPR. 1943 — FRCC

Via Greenfield

. . . the United Nations are daily receiving more and more arms for Freedom. An allied arsenal of supply for Brass, Bronze and Aluminum Ingots, the Samuel Greenfield Co., Inc., is laboring hand in hand with our fighting men. Today, our plant is working around the clock to produce the vital INGOTS needed to build the ships, subs, planes, tanks and guns essential for Victory.

INGOT QUOTATIONS ON REQUEST



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Samuel Greenfield Co., Inc.

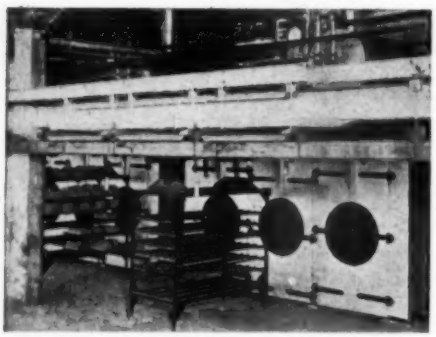
MANUFACTURERS OF BRASS, BRONZE AND ALUMINUM INGOTS

31 Stone Street HUmboldt 4050 Buffalo 12, N. Y.

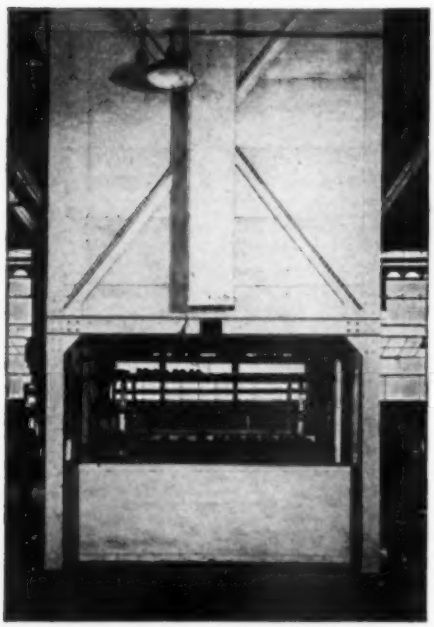
Outstanding SERVICE draws important customers for CARL-MAYER OVENS

Core and mold ovens hold a position of real responsibility. They dictate the speed and character of casting production. It is therefore, a high tribute to Carl-Mayer Ovens to be chosen repeatedly by America's foremost foundries, in face of wide competition.

Consult a Carl-Mayer Engineer, or write for Bulletin 141.



Part of large Carl-Mayer Recirculating Gas Fired Rack Type Oven installation at The General Electric Co.



Typical large Carl-Mayer Vertical Oven as installed for Electric Autolite, Fremont Foundry, Cadillac, General Motors, Packard Motor Co. and The General Steel Castings Corp.

Aluminum Co. of America
American Magnesium Corp.
American Radiator & Standard Sanitary Corp.
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Henry J. Kaiser Co.
Packard Motor Co.
Shenango Penn Mold Co.
Studebaker Corp.
Whiten Machine Works
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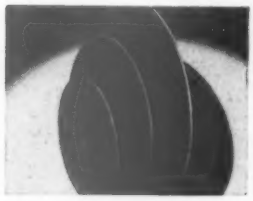
CARL-MAYER CORE AND MOLD OVENS

all types all sizes all fuels

THE CARL-MAYER CORP., 3030 Euclid Ave., Cleveland 15, Ohio

SNAGGING WHEEL



CUT OFF WHEELS

CONE

Wartime production requirements have presented many new and difficult problems to foundrymen. Some of those problems are in the cleaning room.

One sure way to clean up cleaning room problems is to equip your cleaning room with *efficient* abrasives.

MID-WEST snagging wheels, cut off wheels, disks, cones and other foundry type abrasive products are designed and manufactured to handle today's production demands. They last longer, cut faster and cooler because they are designed by engineers familiar with foundry problems. Performance and performance alone is the yardstick used in measuring MID-WEST wheel values. We invite you to apply that yardstick today. It will pay you!

While inquiring about MID-WEST foundry type abrasives don't forget the new MID-WEST grinding wheel dressers and cutters. They are equipped with interchangeable cutters, easily removed by loosening hexagon headed threaded bushings. Ask your MID-WEST representative to demonstrate one to you.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. Milwaukee Avenue • **Detroit 11, Michigan**

HOUGHTON'S
HY-TEN DRY
NO OIL—LITTLE OR NO CEREAL—
JUST MIX WITH SAND AND WATER

CORE BINDERS

A definite advance in core making, for these reasons:

1. **BAKING TIME REDUCED, UP TO 50%,** as compared to former core-room procedure. This means elimination of a production bottleneck, and economy.

2. **LOW BAKING TEMPERATURE**—Cores will bake at 325°F.

3. **CEREAL BINDER ELIMINATED IN MOST CASES.** In 80% of instances investigated, no cereal was used. In the other 20%, only ½ of 1%, or less, was employed.

4. **REDUCED SMOKE WHEN CASTINGS ARE POURED.** Core-room conditions improved, due to absence of toxic or irritating fumes. "Blows" are minimized.

5. **IMPROVED CASTING FINISH**—due to hardness and atmosphere—produced properties of core surface. Smooth finished casting and improved metal structure are thus provided.

6. **IMPROVED COLLAPSIBILITY OF CORES**—due to hard surface and softer center. This lowers cleanout costs, because "break-away" is better when metal is poured.

HY-TEN CORE BINDERS are made from inorganic, inert, finely pulverized material, representing a new concept in core-room practice. They provide cores with good external hardness. Their possibilities as above set forth have led scores of foundries to run extensive tests. For full information preliminary to running your own tests, contact our Foundry Research Department.

E. F. HOUGHTON & CO.

Main Office: 303 West Lehigh Avenue, Philadelphia 33, Penna.

Sales and Service in All Principal Cities

HOUGHTON FOUNDRY RESEARCH HELPS

America's Core Rooms

Fremont Flasks again available in
MAGNESIUM METAL

PROMPT ATTENTION GIVEN ALL ORDERS

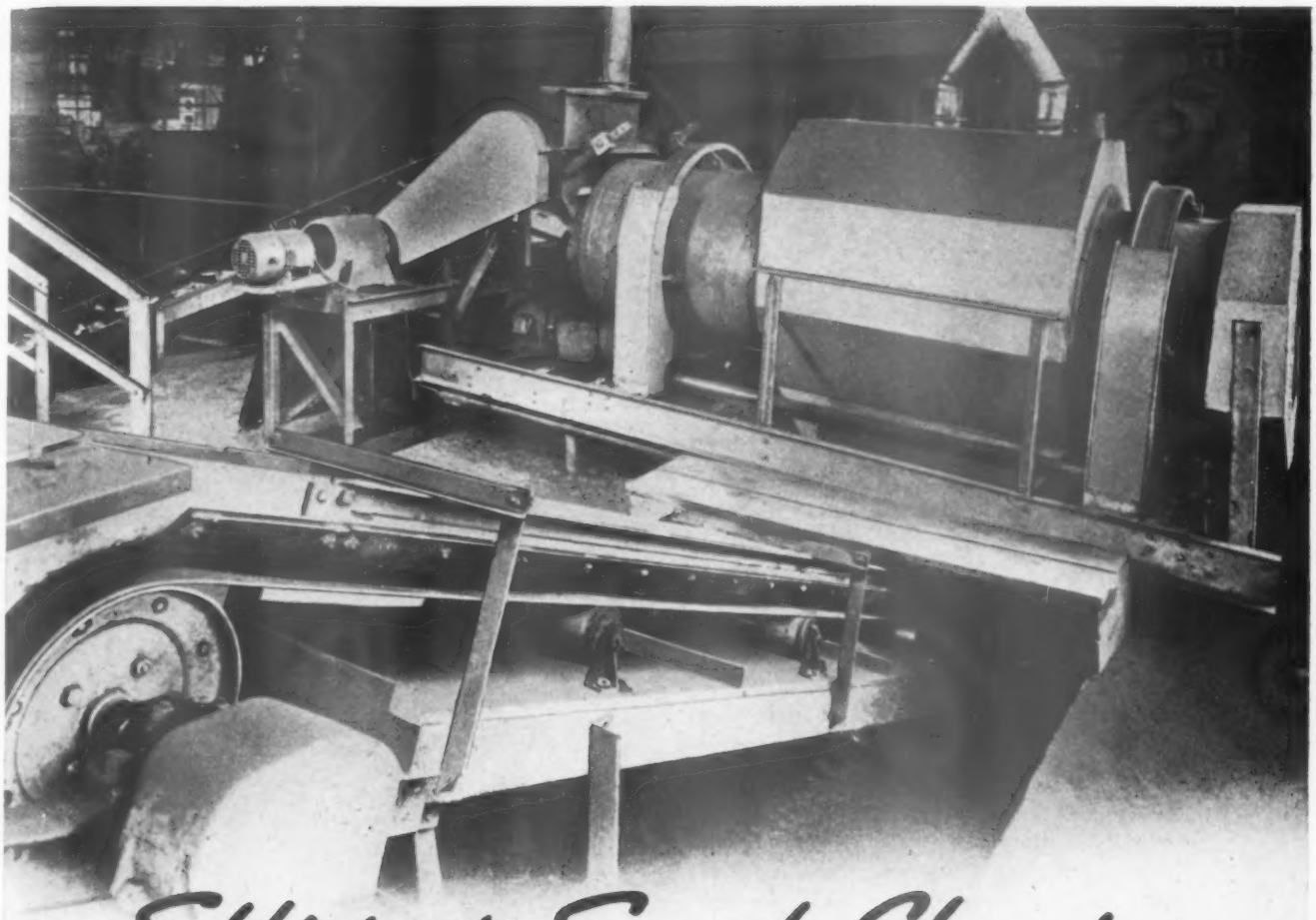
FREMONT FLASKS have established a reputation for efficiency and long wear and in most progressive foundries have replaced the old type, cumbersome, heavy weight equipment.

The FREMONT FLASK with the 1" GROOVLOCK PIN is especially adapted to snap work but can also be furnished with cast ears to accommodate other pins.

Slip Flasks **FREMONT** Jackets

GROOVLOCK

THE FREMONT FLASK CO...FREMONT, OHIO



Efficient Sand Cleaning
is important in small foundries too!

● Fully housed in and vented to a dust collector, this revolving breaker screen in a small steel foundry, cleans up to 30 tons of sand per hour, with almost no dust loss at all. Flights, on the inside of the unhooded breaker section, lift the sand and drop it down on a solid plate, breaking up the lumps, before the sand passes to the wire mesh screening section. Sprues, gaggers, rods and hard-baked lumps are discharged at the end.

Bartlett-Snow Revolving Breaker Screens can handle dry, hot, cold or any intermediate condition of sand,—range from 30″ to 84″ in diameter. They meet all requirements for on-the-floor or overhead mounting — and are installed usually with magnetic pulleys which are placed either before or after the screen, depending upon conditions.

Our recently issued 40-page Bulletin No. 91 which illustrates many different arrangements of revolving and vibrating screens,—and other Bartlett-Snow Foundry Equipment—will be of great interest to every foundryman. Send for a copy!

THE C. O. BARTLETT & SNOW CO.

6201 HARVARD AVENUE • CLEVELAND, OHIO

Engineering and Sales Representatives in the Principal Cities

FOUNDRY SAND, MOLD AND CASTINGS HANDLING • • DUST AND FUME CONTROL SYSTEMS • •

SPECIMEN PREPARATION

made easy with precision built **Buehler**

METALLURGICAL TESTING EQUIPMENT

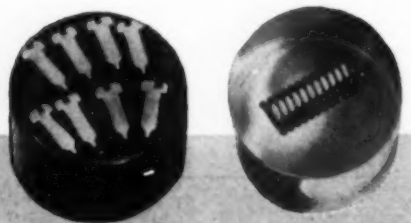
WET POWER GRINDER NO. 1215

for coarse and medium-coarse grinding

The entire side surface of the 12 inch wheel is exposed for grinding; thus giving a wide range of surface speeds. A specially designed guard provides adequate protection to the operator without restricting the area of grinding surface. Housed in the base is a self-contained recirculating cooling system that supplies a soluble oil coolant independently to each wheel. The oil coolant also serves to prevent rusting of machine parts and specimens. An outstanding feature of this machine is the freedom from oscillation and vibration. Buehler equipment is noted for its smooth running qualities that are the result of precision built parts and carefully engineered construction.

A complete line of equipment for specimen preparation available from one reliable source

Cut-off Machines • Specimen Mount Presses • Power Grinders • Emery Paper Grinders • Hand Grinders • Belt Surfacers • Polishers • Polishing Cloths • Polishing Abrasives

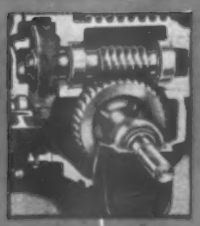


Buehler Ltd.

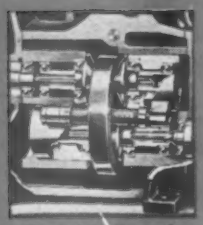
A PARTNERSHIP

METALLURGICAL APPARATUS

165 West Wacker Drive, Chicago 1, Illinois



Gearhead Unit

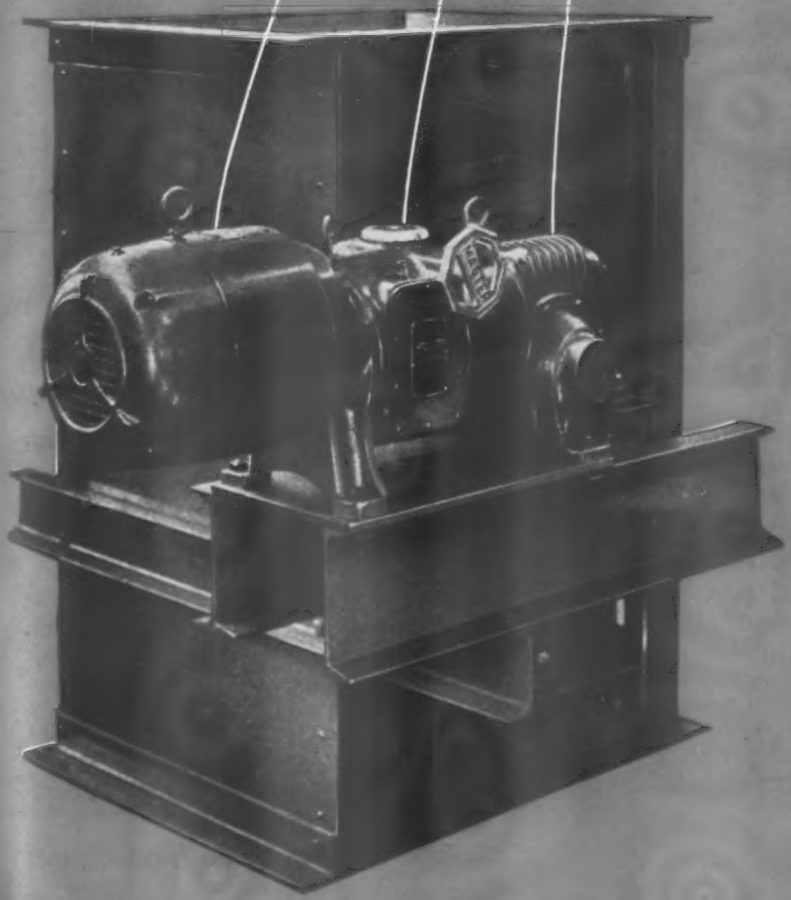


Variable Speed Unit

Fan-cooled Motor

easily combine to form a compact integral power unit

which adds greatly to the economy, safety, compactness and appearance of the finished product.



easy does it

This is just one of the thousands of combinations that can be secured in the Master Line, which is the most versatile, the most flexible line of motor equipment available.

Single phase, squirrel cage, slip ring, multi-speed, synchronous, direct current, enclosed, splash-proof, fan-cooled, explosion proof, elevator, hoist, reversing, gearhead, Speed-rangers, Unibrake, vertical and horizontal flange units . . . all are designed so they can be easily combined to provide the power drive best suited to each application.

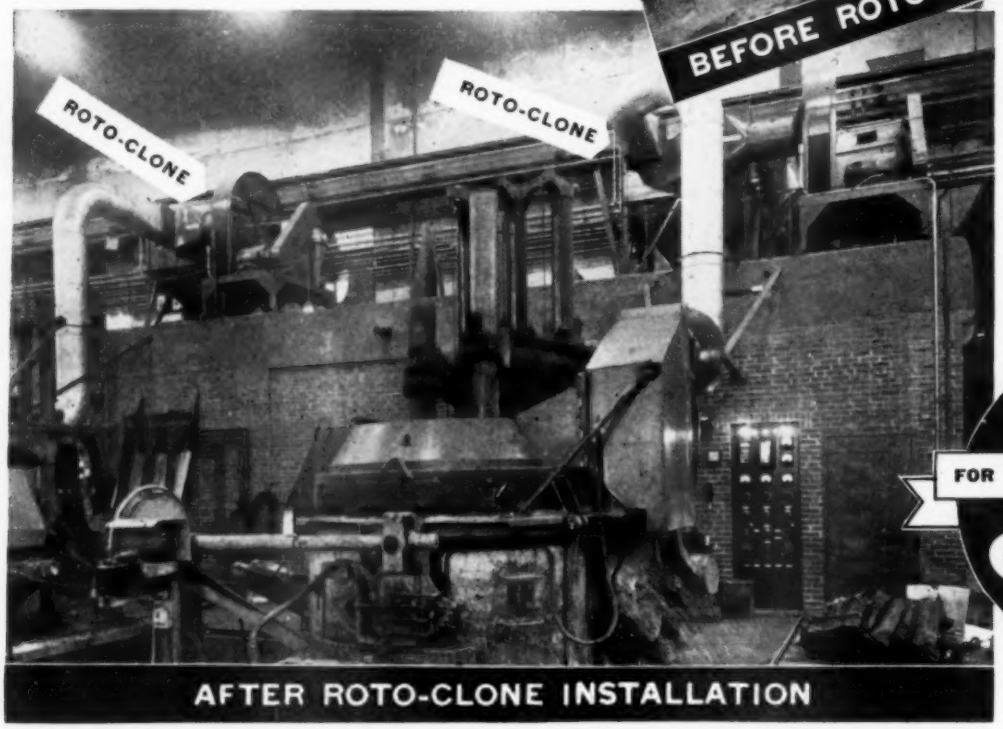
Investigate Master's unusual ability to serve you economically with motors that really fit the job exactly.

THE MASTER ELECTRIC COMPANY
DAYTON 1, OHIO

BEFORE *and* AFTER

PHOTOGRAPHS PROVE EFFECTIVENESS OF ROTO-CLONE DUST CONTROL FOR ELECTRIC FURNACES

These unretouched photographs are visual evidence of Roto-Clone's efficiency in the control of electric furnace dust. Roto-Clone is equally effective in the control of dust at shakeouts, sand screens, belt transfers, magnetic pulleys, mullers, elevators, sandblast, casting cleaning, tumbling mills and grinding.



ROTO CLONE
FOR FOUNDRY DUST CONTROL

General ventilation is rarely adequate to control dust from electric furnaces. In the foundry where above pictures were taken, two Roto-Clones exhausting 16,000 c.f.m. completely eliminated the dust nuisance where more than 120,000 c.f.m. of general ventilation utterly failed. Other Roto-Clone advantages include regulation of air volumes up to the maximum required at high temperature peaks and an almost constant inflow of room air regardless of high temperatures attained when air passes thru the furnace hood.

Send for complete information on the Roto-Clone for all foundry operation dust control. Ask for Bulletin No. 274.

AMERICAN AIR FILTERS

AMERICAN AIR FILTER COMPANY, INC., 266 CENTRAL AVE, LOUISVILLE, KY.
INCORPORATED
IN CANADA, DARLING BROTHERS, LIMITED, MONTREAL, P. Q.

THEY FIT ANY LAYOUT

CLEARFIELD Mixers, in all capacities, are compact, require minimum headroom, and fit readily into the particular requirements of any installation. Clearfield engineers will work helpfully with the engineering department of the customer or with the designers of the conveying equipment manufacturer.

When you specify CLEARFIELD you are assured the proved advantages of sand conditioning the Clearfield way, together with complete freedom in your selection of engineering service.

CLEARFIELD
MACHINE COMPANY

CLEARFIELD
PENNSYLVANIA, U. S. A.

Two Core Oil Tests...Only One Result

Standardization on

SAFCO Core Oils

Cores Rap Out Easily—No Shrinkage Cracks

Cores entirely surrounded by metal and removable only through very small openings threatened to swell production man-hours in an Eastern magnesium foundry. Consultation with a Swan-Finch Service Engineer resulted in a plant test of TYKOR COMPOUND.

TYKOR COMPOUND produced cores which collapsed very readily and were easily removed, after only one or two raps.

No shrinkage cracks were encountered and the customer reports that the mix draws very clean from the core boxes.

Baking Time Reduced 25% ... Core Breakage Minimized

An Eastern foundry, casting both gray iron and semi-steel for the jobbing trade, invited a Swan-Finch Service Engineer to survey their core-room practises and to make a recommendation for the improvement of their production. SAFCO #414 Core Oil was suggested as being best suited to their plant conditions.

Results of the test on SAFCO #414 showed that it had decreased baking time by approximately 25%.

It also reduced core-box sticking and practically eliminated core breakage... a performance record considerably better than that of the core oil which SAFCO replaced.

New foundry hands need "old heads" to meet the accelerated production schedules of today! With half a century of cumulative experience behind the compounding of SAFCO Core Oils, Swan-Finch Service Engineers are equipped to help your foundry employees—old or new—make better castings.

We suggest that you prove SAFCO superiority to your own satisfaction...on terms that are simple, inexpensive and conclusive. Let the Swan-Finch Service Engineer recommend the proper SAFCO Core Oil for your specific purpose—run the test in your own plant...judge the results for yourself. If you do not get better performance with SAFCO Core Oils and Binders... we'll cancel your invoice for the test drum.

Swan-Finch Oil Corporation

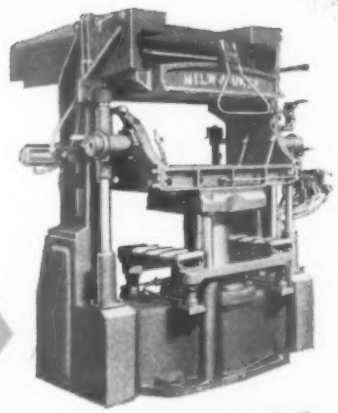
R. C. A. BUILDING (WEST), NEW YORK 20, N. Y. • 2596 Hart Avenue, Detroit 14, Mich. • 201 North Wells Street, Chicago 6, Ill.

MAKERS AND MARKETERS OF **SAFCO** CORE OILS AND COMPOUNDS • **SAFCO** METAL WORKING LUBRICANTS • **SAFCO** MAINTENANCE LUBRICANTS • **SAFCO** LUBRICATING SPECIALTIES

See us at our booth at the 1944 Foundry Show, Buffalo!

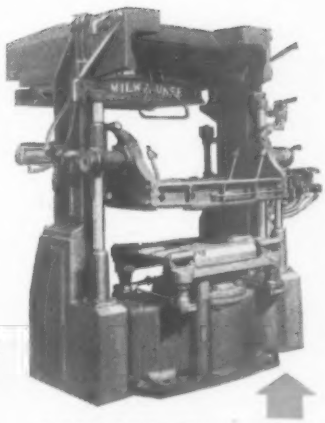
"80 Molds per Hour! — that's what I call Real Production"

"It seems unbelievable, but it's a fact, nevertheless — I tried out one of those modern MILWAUKEE Jolt Squeeze Rollover Draw Machines in our foundry and the actual production count was 80 molds per hour. Fast? You just can't beat it! Every operation — Jolt — Squeeze — Rollover — Pattern Draw — is performed in correct sequence and in the simplest operating cycle. And during the entire cycle, the squeeze piston takes only ONE STROKE! Accurate? It's truly amazing. The machine maintains accuracy and precision under the most difficult conditions. Yes, sir—if you're looking for a machine to speed up your war production, I certainly would recommend a MILWAUKEE Jolt Squeeze Rollover Draw."

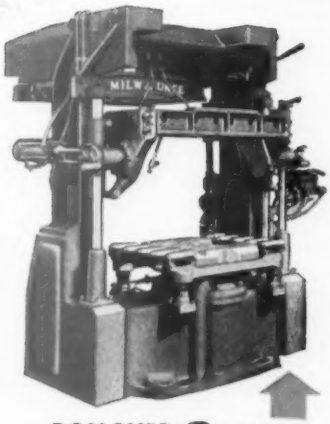


JOLT *Position*

SQUEEZE *Position*



ROLLOVER *Position*
(before rolling over)



ROLLOVER *Position*
(after rolling over)

Use the Milwaukee Jolt Squeeze Rollover Draw for DRAGS, and the Milwaukee Jolt Squeeze Pin Stripper or Jolt Squeeze Stripper for COPES—the perfect combination for your foundry.

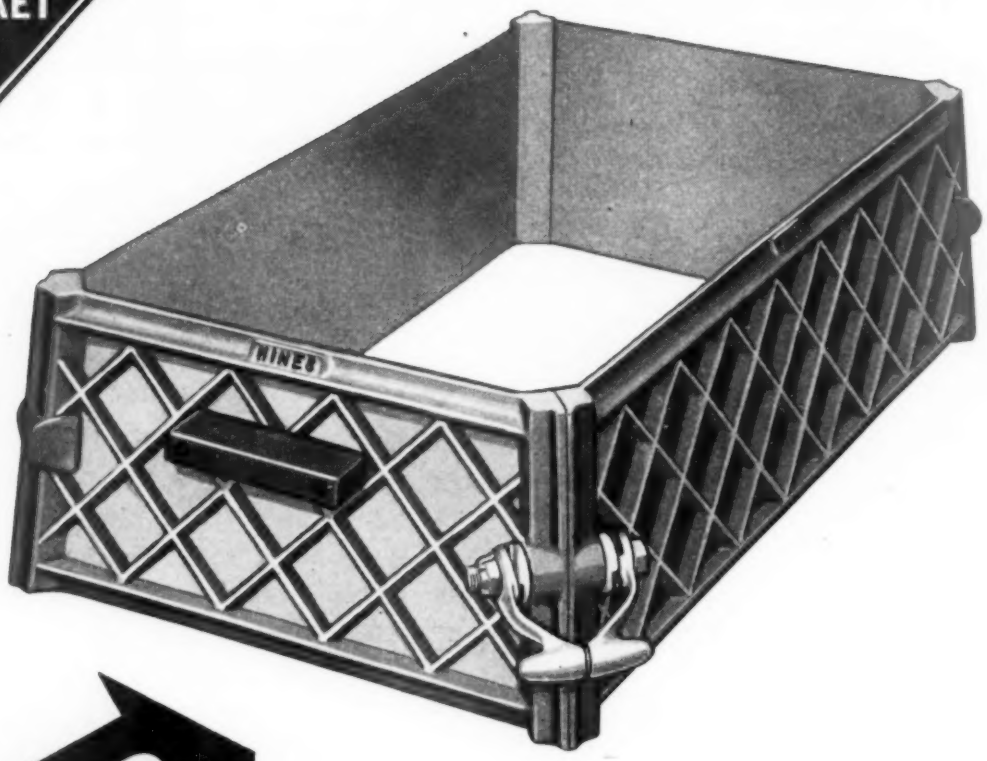
MILWAUKEE *Foundry Equipment* **Co.**

3238 W. PIERCE STREET, MILWAUKEE 4, WISCONSIN, U.S.A.

. . . . THIS HINES

HINES
POP-OFF
TRADE MARK
JACKET

will solve your b



CLOSED
. . . WHILE POURING

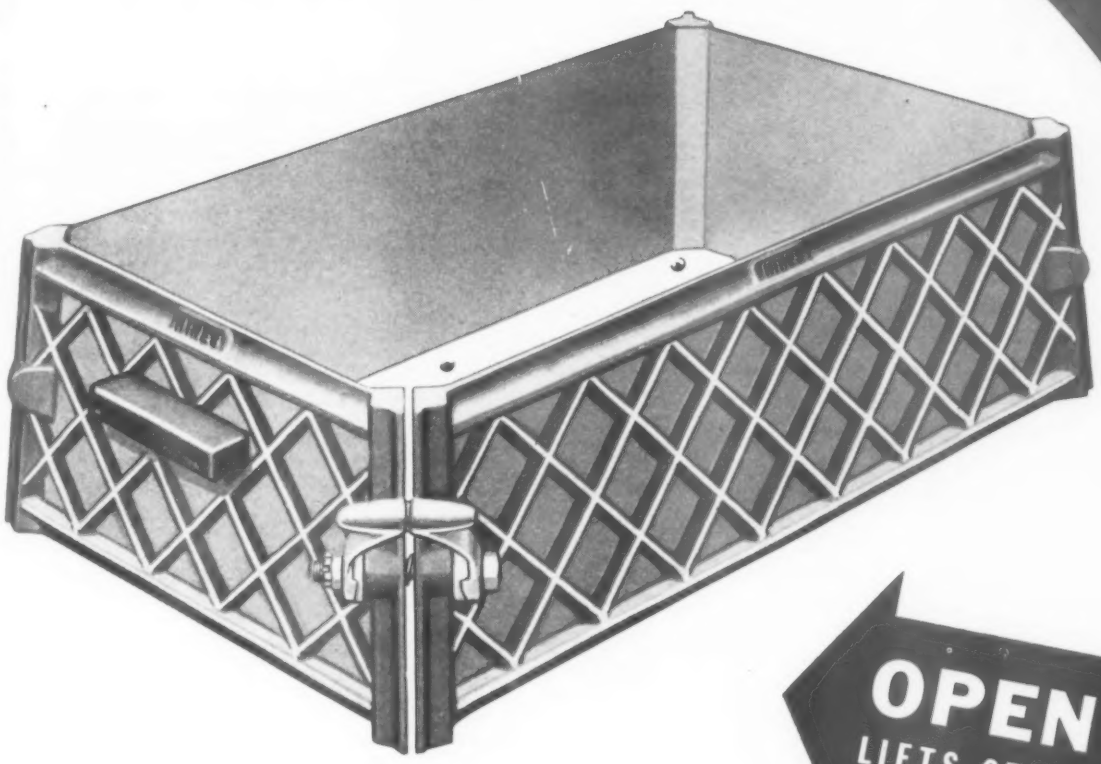
● NO POUNDING OR MAULING this jacket to get it off the mold . . . just raise the lever and it pops right off. Custom built and built to fit. Made of either

THE HINES

1324 HIRD AVENUE

"Pop-Off" (TRADEMARK) JACKET

breakage problem



OPEN... LIFTS OFF EASILY

aluminum or cast iron. Extra wall thickness at the parting. Get the best in jackets . . . and they'll be Hines "Pop-Off" Jackets. (PATENT APPLIED FOR)

FLASK CO.

CLEVELAND 7, OHIO

Typical benefits of DESPATCH-ENGINEERED OVENS

FASTER BAKING of capacity loads; ideal heat and airflow conditions to meet your production needs.

REDUCED COSTS for fuel as heating system is fitted to your job; gives *maximum* heat efficiency.

EASIER OPERATION with automatic controls, easy loading. Increases core output per man.

USE LESS FLOORSPACE with design that fits your foundry layout. Saves steps, eases entire core-making setup.

ADDED FLEXIBILITY for all present and future core-baking needs. Helps beat competition, increases profits.

"FOUNDRY-FITTED" DESPATCH OVENS BOOST CORE PRODUCTION-PER-MAN

To bake most cores for least cost, in terms of effort, fuel, space and time required, there's no substitute for a *specially-engineered* Despatch oven, designed for *your* job.

With its construction, operation and performance exactly dovetailed to your foundry's needs, you get unequalled baking efficiency.

The oven above was specially designed and "foundry-fitted" by Despatch engineers. Vertical conveyor saves steps in loading . . . compact design shortens entire coremaking line . . . balanced heater-fan-duct system gives fast, even baking . . .automatic controls keep heat at correct level. Everything in fact, to do the job *best*—and most profitably.

This is a *planned* oven from top to bottom, typical of what *you* can obtain with the help of Despatch engineers.

ASK FOR HELP NOW in planning the *best* oven for your corebaking requirements today . . . and tomorrow. Call for a thorough foundry survey by one of the 75 Despatch resident engineers. The results will be worth it!

DESPATCH
OVEN COMPANY MINNEAPOLIS

Flame Scarfing

cuts time required for removing riser pads

Here is another new Airco development that is helping foundries meet wartime demand for steel castings—

In actual tests on duplicate pieces, flame scarfing has proven as much as 50 times as fast as grinding and half again as fast as "washing" with the carbon arc.

Further savings of time and manpower are effected because the work requires no heavy or expensive equipment and can be performed wherever the castings are located. Costly inter-departmental handling is eliminated.

—And a better job results because the scarfing torch used for the work actually washes away the surface of the pad to any desired depth, producing a smooth, high-quality surface. The depth of the cut can be controlled within 1/16 inch by an experienced operator.

For further details of this important time and cost saving process and other Airco developments that are helping foundries speed production and reduce costs, fill out and mail the coupon. It will bring you by early return mail a copy of the 32 page booklet, "New and Improved Oxyacetylene Methods for Steel Foundries", now on the press.

AIR REDUCTION SALES CO.
60 East 42nd St.
New York 17, N. Y.

Date.....

Gentlemen:
Kindly forward to me by early return mail a copy of your booklet, "New and Improved Oxyacetylene Methods for Steel Foundries".

NAME.....
TITLE.....
FOUNDRY.....
ADDRESS.....
CITY..... STATE.....

★ BUY UNITED STATES WAR BONDS ★

AIRCO WILSON

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General Offices: 60 East 42nd Street, New York 17, N. Y.
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NATIONAL STEEL CORPORATION

THE HANNA FURNACE CORPORATION

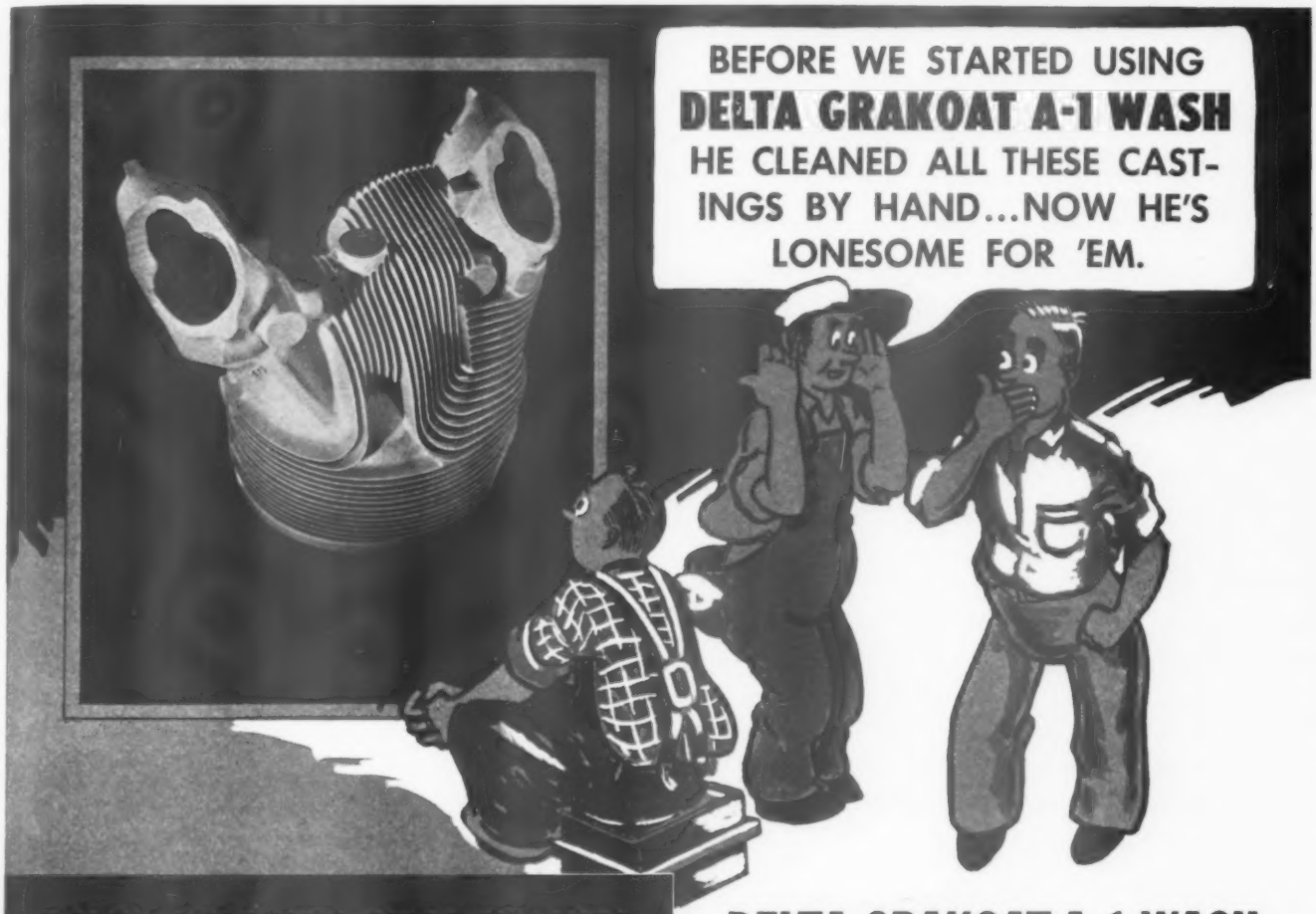
Buffalo Detroit New York Philadelphia Boston

Merchant Pig Iron Division of

NATIONAL STEEL CORPORATION

Executive Offices: Pittsburgh, Pa.

CLEANING ROOM CLAUDE...HIS "PIN-UP GIRL!"



DELTA CORE AND MOLD WASHES

For STEEL
DELTA STEELKOAT
DELTA SPECIAL CORE AND MOLD WASH
For GREY IRON AND MALLEABLE
DELTA GRAKOAT
DELTA BLACKOAT
For NON-FERROUS METALS
DELTA NON-FERRUSKOAT
DELTA GRAKOAT A-1 (For Aluminum)
Other Popular DELTA Foundry Products
DELTA PARTEX—Nut Shell Parting
DELTA NO-VEIN Compound
DELTA SPRAY BINDERS
DELTA MUDDING COMPOUND
DELTA CORE OILS

DELTA GRAKOAT A-1 WASH

FOR ALUMINUM CASTING

1—ELIMINATES POROSITY
2—REDUCES SCRAP LOSS
3—SUBSTANTIALLY REDUCES CLEANING ROOM COSTS.

DELTA GRAKOAT A-1 Wash is a chemically active wash . . . a product entirely unique and original in the science of Core and Mold Wash development.

Its particular and unusual function is the elimination of oxide formation, by chemical action, when metal is poured.

For complete information write direct to

ARMY E NAVY

DELTA OIL PRODUCTS CO.

MANUFACTURERS OF
INDUSTRIAL AND AUTOMOTIVE OILS, GREASES AND COMPOUNDS
MILWAUKEE 9, WISCONSIN

1000 TONS A MONTH—

Every operation involving sand preparation, mulling and pouring 1000 tons of steel castings a month, is performed by a midwestern foundry on a floor space only 40 ft. by 160 ft.—an area about 1/8th the floor space commonly required for output of that size.

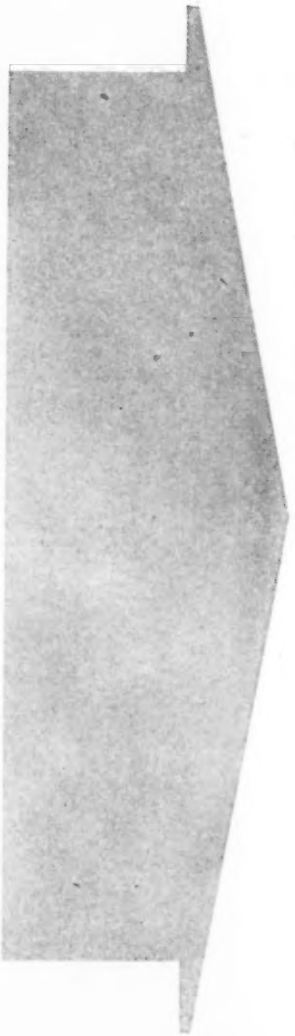
That is the remarkable performance of a Beardsley and Piper installation which proves again that the Speedmullor and the Sandslinger save valuable floor space and make work areas many fold more productive.

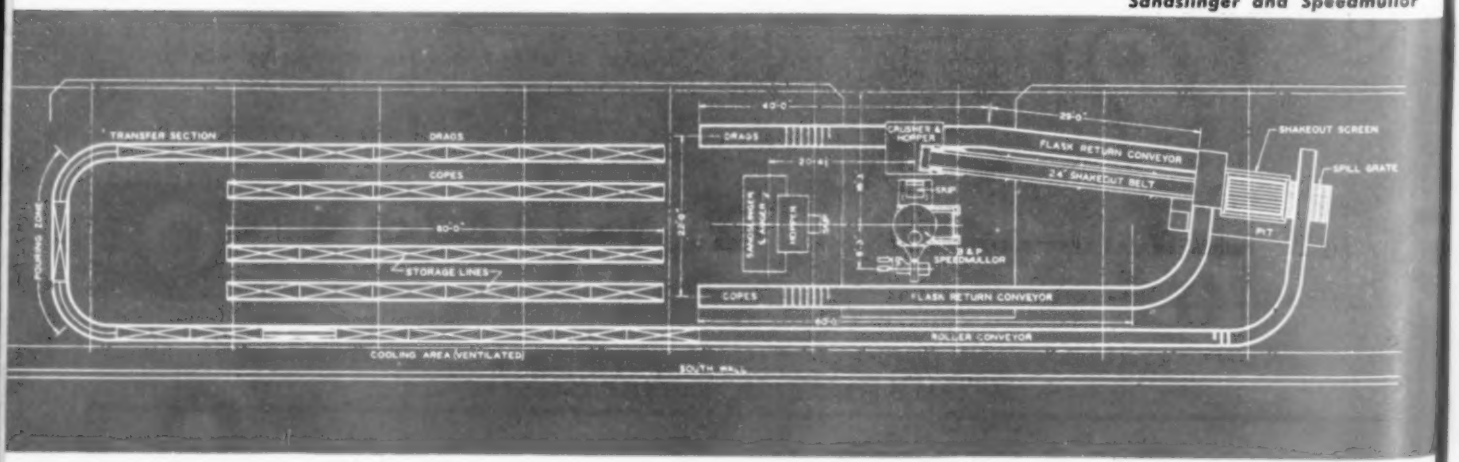
The installation is simple—consisting of a conveyor system, a No. 60 Speedmullor, a Stationary Type Sandslinger, two skip hoists, one to serve the mullor and one to feed the Sandslinger, and push-off and strip machines. This complete unit produces 1000 tons a month—16 tons per month per 100 sq. ft. of floor space.

Not an experienced steel foundryman was in the crew when this unit was started. The patterns were properly designed for steel—the Speedmullor thoroughly prepares the sand for steel—the Sandslinger rams the molds to the correct density and hardness for steel. The result—this remarkable steel unit was a success from the day it was put in operation.

You, too, can have all the advantages of Beardsley and Piper equipment. Call in a B & P engineer. He will study your problems and, without obligation, will show you how B & P sand preparation and ramming methods will increase the output, save floor space, produce finer castings, save metal, cut rejections, open new markets, and increase profits.

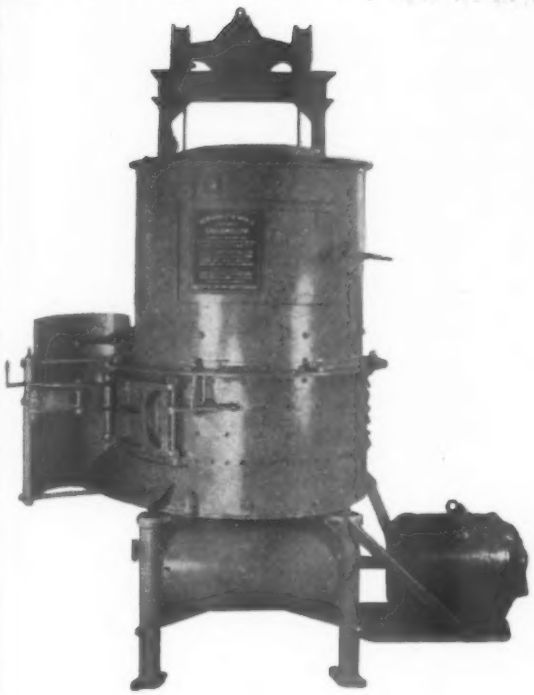
Let us know today when you want a B & P engineer at your foundry.





Floor layout of the steel unit, showing the locations of the Sandslinger and Speedmullor

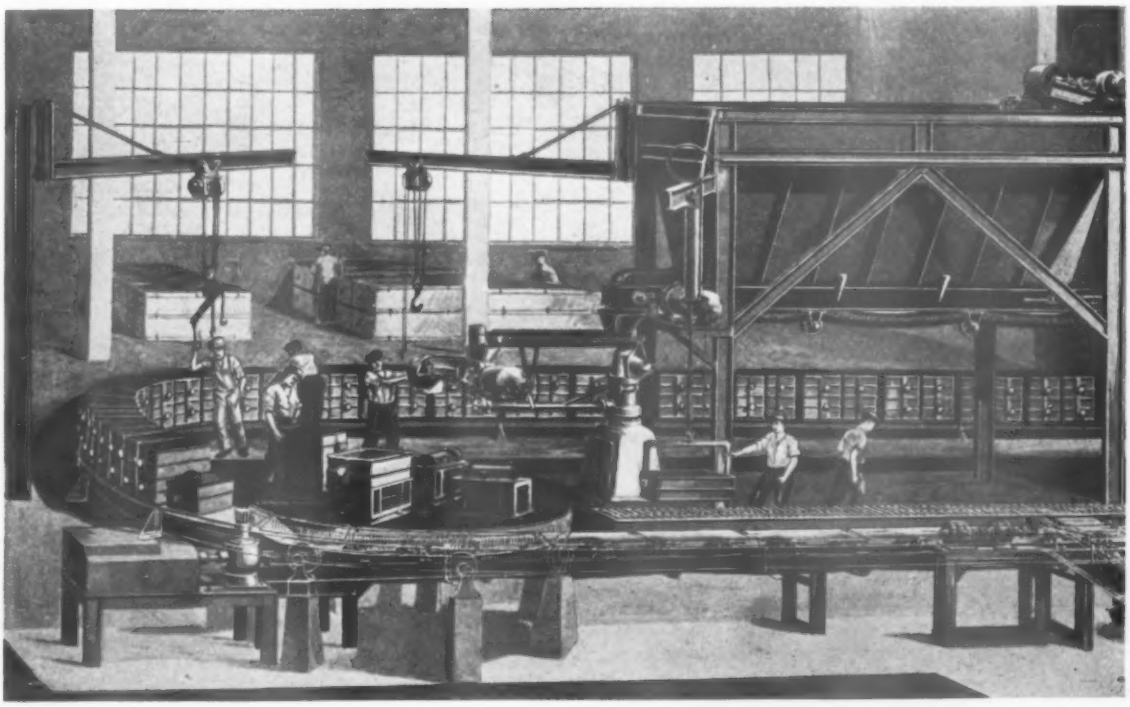
WORK FLOOR 40' x 160'



This combination—a B&P Speedmullor and a B&P Sandslinger—is the reason for tremendous output from a small work floor.

The Speedmullor mulls and aerates the sand between two pieces of live rubber—the rubber wall and the rubber tire. It quickly cools sand—and it mulls 4½ times more sand per hour for every square foot of floor space than can be obtained by any other method. Speedmullors are made in capacities from 3 to 20 cu. ft. per batch.

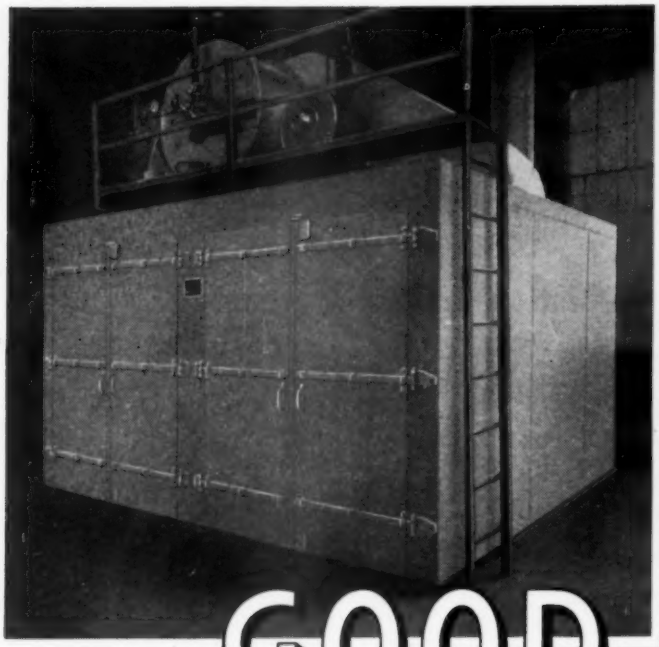
Sandslingers do not use air as the ramming medium—they are entirely mechanical in operation. They take the uncertainties of the human element out of mold making by ramming to an even predetermined density which can be easily controlled for varying kinds of work—light, medium, or heavy. Stationary Type Sandslingers are made to ram from 7 to 10 cu. ft., or about 1000 lbs. of sand per minute.



THE BEARDSLEY & PIPER COMPANY "BETTER METHODS" B&P

THE BEARDSLEY & PIPER COMPANY

2541 NORTH KEELER AVENUE CHICAGO 39, ILLINOIS



GOOD OVENS

Bake cores and molds at maximum speed.

●

Require less fuel per bake.

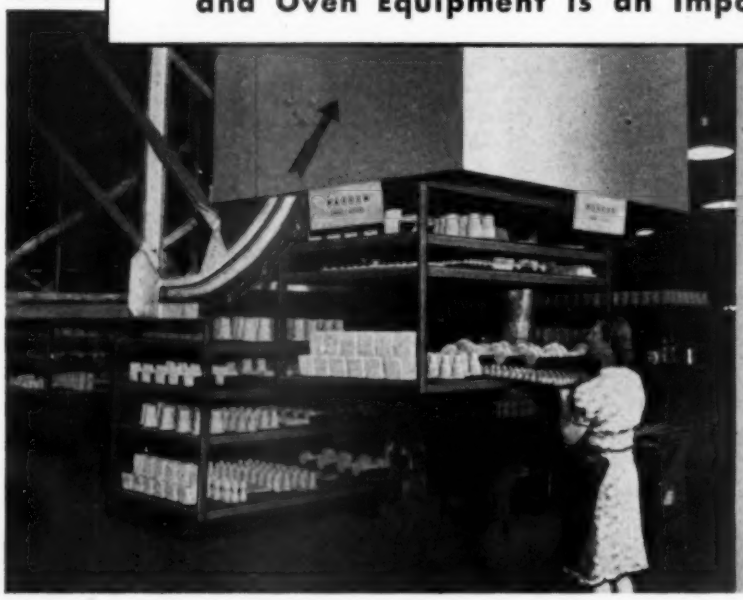
●

Produce dependable cores and molds consistently.

●

Can be engineered for any type of heating, any kind of fuel and any method of handling the product.

NOW IS THE TIME to prepare for Postwar Competition and Oven Equipment is an Important Thing to *Check*



YOUNG

BROTHERS COMPANY

6508 MACK AVENUE

DETROIT, MICHIGAN

Make Sounder Castings - Save Metal

with "NATIONAL" GRAPHITE RODS

in Blind, Semi-Blind or Open Risers of All Steel Castings

Left, quarter section view of typical blind feed riser shrink from steel casting using a core sand vent rod. Right, typical blind feed riser shrink from same mold set up as on left except with use of a *graphite rod* fixed across diameter of riser.

A sectioned open riser after use of a double-pointed graphite rod. Illustrates characteristic shallow shrink entirely sealed within solidified metal.

THE SUBSTITUTION of "National" graphite rods for the ordinary core sand rods in blind, semi-blind and open risers for open hearth, electric steel and alloy steel castings has produced these important results—

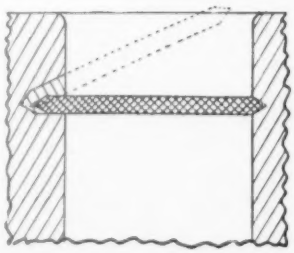
Blind and Semi-Blind Risers—Increased fluidity of the riser metal—due to its lower melting point and higher temperature with slower freezing—increases the flow of metal into the casting. The shrink cavity, being flat bottomed instead of carrot shaped, makes shorter risers possible and reduces volume of metal. Smaller cross-sectional area of runners saves metal and lowers cutting and grinding costs.

Open Risers—Internal gas pressure under the solidified metal causes flatter cavity and forces more metal into the casting thus producing sounder castings, especially those difficult to pour. "National" graphite rods reduce riser dimensions, both cross-sectional and height, and decrease amount of metal necessary for pouring (increase of yield). Net savings in poured metal run from 30% to 60%. Cutting and grinding costs are lowered.

Carbon Pickup Negligible

Strong **Easy to Use** **Low Cost**

BUY UNITED STATES WAR BONDS



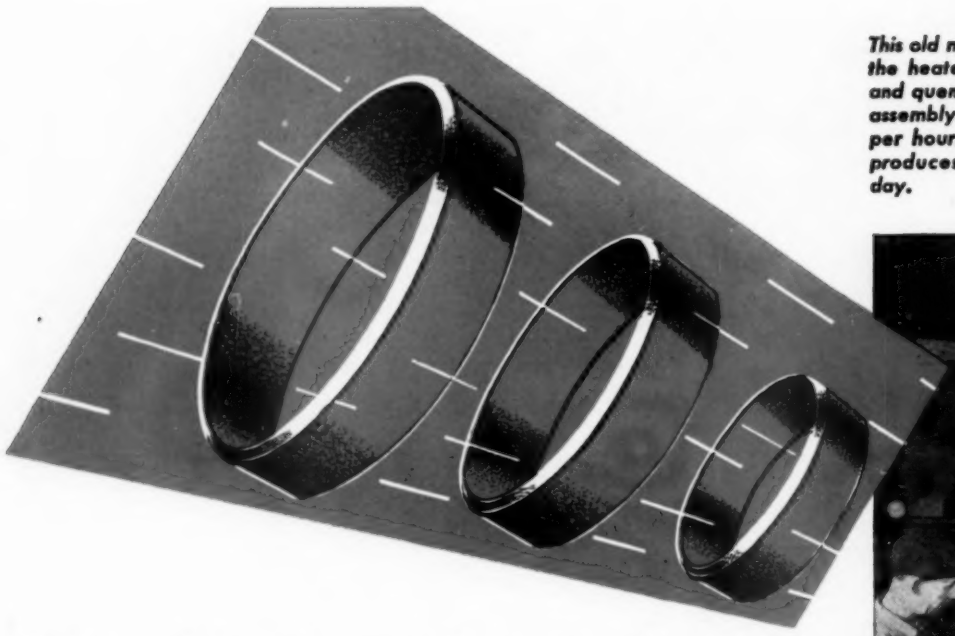
Method of using double-pointed graphite rod in open riser.

The word "National" is the registered trade-mark of National Carbon Company, Inc.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

CARBON PRODUCTS DIVISION, Cleveland 1, Ohio UCC New York, Pittsburgh, Chicago, San Francisco



This old method of putting the heated ring on a jig and quenching the whole assembly produced 8 rings per hour. Super-Cyclone produces 432 rings per day.

The Lindberg Super-Cyclone Keeps Work Straighter

saves time . . . cuts costs

REDUCING the need for difficult straightening, or eliminating costly preventive measures, can speed up heat-treating production and save in many ways. The Lindberg Super-Cyclone Furnace is doing just this for users because of the heating principle on which it operates. Fan-driven hot air developed in an isolated chamber builds up temperature with rapid uniformity *throughout the charge* to as much as 1750°F. There is no direct radiant heat to cause distortion.

A bearing manufacturer placed each "race" on a special jig to hold an acceptable "round" after quenching. Produced 64 per 8 hour day. With the Super-Cyclone an operator working only 1½ hours a day, loading 63 rings at a time on a fixture, quenching all at once without jigs, yet holding to within .006" to .010" of round, finished 432 per day—*7 times more production.*

Besides keeping work straighter, saving time and saving space, the Super-Cyclone can be used for normalizing, hardening and tempering, because temperature can be accurately controlled between 300° and 1750°F.

Write for complete information to: Lindberg Engineering Company, 2453 W. Hubbard St., Chicago 12.

LINDBERG FURNACES

ARMY E NAVY

SUPER-CYCLONE for hardening, normalizing, annealing, tempering
CYCLONE for accurate, low-cost tempering and nitriding
HYDRYZING for scale-free and decarb-free hardening

Magnaflux indication of a shrinkage crack in a large flywheel.

. . . *in the* FOUNDRY

MAGNAFLUX RESEARCH

Since the pioneering stage of the original Magnaflux Method for steel, our engineers have sought to extend the benefits of *rapid non-destructive* inspection techniques in every field. For the important foundry industry special portable equipment and new procedures for more sensitive results were developed.

● When the foundry's customers, or any other departments along the production line, discover flaws in castings the foundry is on the defensive.

With Magnaflux* every piece and part can be examined in the foundry for shrinkage cracks, porosity, blow-holes, scabs and surface cracks. Surface indications are obtained which indicate all surface and many sub-surface flaws.

This means that a high percentage of all foundry rejects can be kept out of other hands—their causes promptly traced and eliminated—resulting in invaluable savings in time and material as well as reputation.

Let us tell you the Magnaflux story for foundy executives. Write for the details.

**Magnaflux—the Trade Mark of the Magnaflux Corporation applied to its equipment, materials and methods for magnetic particle inspection.*

MAGNAFLUX CORPORATION
5918 Northwest Highway, Chicago 31, Illinois
NEW YORK • DETROIT • DALLAS • LOS ANGELES • CLEVELAND • BIRMINGHAM

3

HYDRO-BLAST ROOMS

at American Manganese Steel Division

OF THE AMERICAN BRAKE SHOE & FOUNDRY COMPANY

American Brake Shoe News says: "With this modern Hydro-Blast equipment, our Amsco plant is blasting the steel scale much faster than has ever been done before, and achieving a cleaner, brighter surface on manganese steel castings."

The three Hydro-Blast rooms at the Amsco plant enable three operators to work simultaneously without interference. The operators are fully protected with rubber coats, pants, boots and gloves.

Helmets are equipped with safety glass windows permitting the operators to stand close to the work and most effectively direct the high velocity stream of sand and water. The helmet window is flushed clean every 7 seconds and fresh air is delivered constantly to the operator.

Another Hydro-Blast feature at Amsco is the suppression of dust at the source and the partial conditioning of air in the annealing department where the Hydro-Blast system is located.

This air conditioning is accomplished by the high velocity water stream which travels 18,000 feet per second as it leaves the Hydro-Blast gun, dragging the surrounding air with it to leave a low-pressure area or partial vacuum so that other air continuously rushes in and fills the space surrounding the stream. As the dust-laden air is drawn into the low pressure area, the dust particles meet the high velocity stream with great impact, are immediately wetted out, dropped from the air and drained away with the water.

Some Amsco manganese steel castings are brought into the Hydro-Blast rooms by crane. Others are placed on a turntable which projects halfway out of one room. When the outside of the turntable is loaded, the table may be turned 180 degrees to bring the castings into the room.

Each Hydro-Blast Installation Is "Tailor-Made"

No two foundries have the same production facilities so every Hydro-Blast system has been specially designed to fit the exact needs of the shop in which it is installed. Hydro-Blast's basic functions include fast and economical casting cleaning; saving of invaluable transport ton miles; enormous money economies effected through the recovery of sand for reuse, and the release of millions of man hours for other essential work.

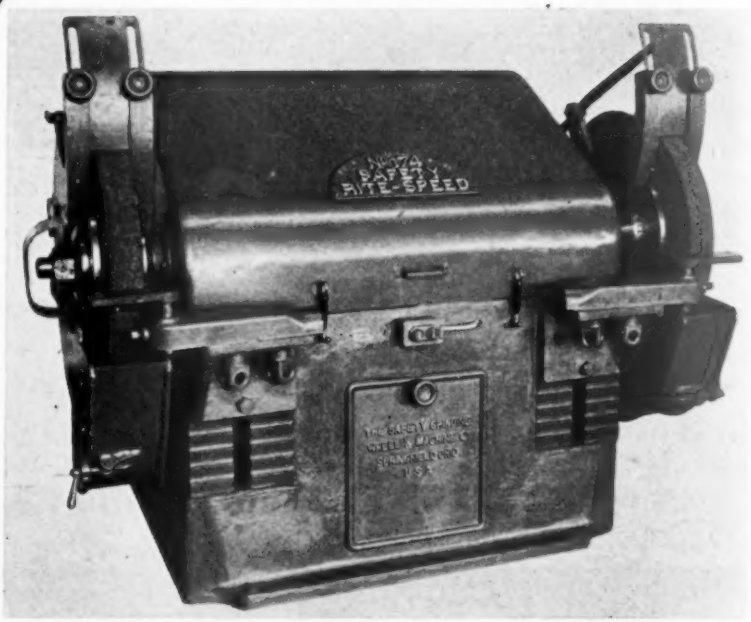
May we tell you how most Hydro-Blast systems pay for themselves during the first year of operation?

THE HYDRO-BLAST CORPORATION

2550 N. WESTERN AVE.

CHICAGO 47, ILLINOIS

Here's a Powerful Home "Front Line"



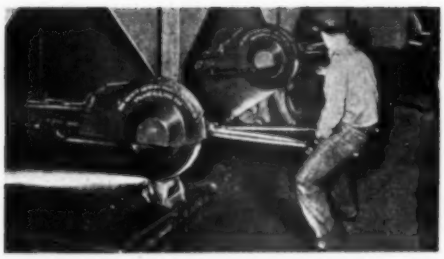
SAFETY

GRINDING WHEELS and SWING FRAME GRINDERS

YES, these advanced SAFETY products can form a mighty important "front line" in your plant to help the boys dish it out on the front lines over there. With this SAFETY combination you'll get faster, safer snagging. You'll get a finer finish. And with less fatigue on the part of the operator . . . less lag at the end of the shift . . . more even production flow. Factors which can't be ignored these days!

Accept this FREE Service

But there are other time, labor and money saving SAFETY products to meet today's needs. Why not let one of our foundry engineers check your equipment with you? He may have some suggestions you'll want to adopt. In any event, this service is yours for the asking. No obligations, of course! Simply write or phone the SAFETY factory.



SAFETY De Luxe Swing Frame Grinder:— Used with SAFETY Grinding Wheels, assures faster, safer snagging. Speeds production! Cuts cost!

SAFETY "Rite-Speed" Double End Stand Grinder:— Changeable speed. Automatically cuts off power when grinding wheels near to predetermined diameter. Many other advantages. Write for details!

THE SAFETY GRINDING WHEEL & MACHINE CO.

Main Office and Factory SPRINGFIELD, OHIO, Phone 4651

SAFETY

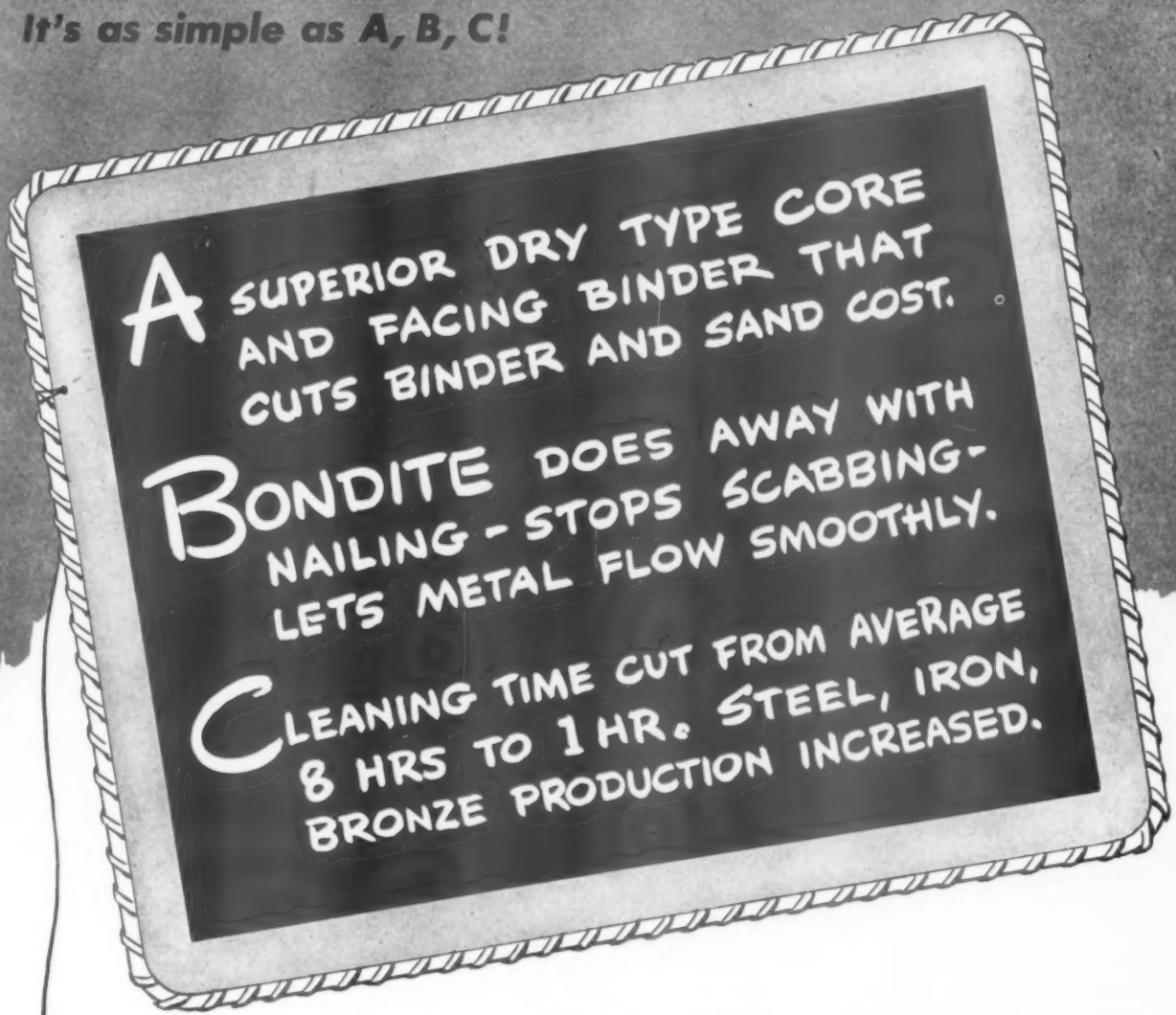
PO-6319-AD61

MR. FOUNDRYMAN...

LET'S LOOK TO THE FUTURE!

Will your foundry again be ready for competition?

It's as simple as A, B, C!


A SUPERIOR DRY TYPE CORE AND FACING BINDER THAT CUTS BINDER AND SAND COST.
BONDITE DOES AWAY WITH NAILING - STOPS SCABBING - LETS METAL FLOW SMOOTHLY.
CLEANING TIME CUT FROM AVERAGE 8 HRS TO 1 HR. STEEL, IRON, BRONZE PRODUCTION INCREASED.

It's no secret that the successful postwar operation of your foundry will depend upon giving your customers better service and better castings at lower cost. BONDITE is doing its part in the war by helping to increase the production of castings in many foundries throughout the United States and Canada. BONDITE can help you today in your efforts toward victory — and in your plans for tomorrow. Write for complete information.

Bondite Corporation

2325 EAST 38TH STREET, LOS ANGELES 11, CALIFORNIA

844 150TH STREET, HAMMOND, INDIANA

You Have to Know a Lot about Good Foundry Practice to do Business with nearly all the Foundries in America!

OSBORN *does* business with most of the foundries in America.

Not just today—but for the past 50 years.

Because of this broad and thorough experience, Osborn moulding specialists have been called in for consultation by leading foundries, now working on reconversion plans for production in a competitive postwar market . . . a market in which the foundry that can produce a better product at a lower cost will again lead the field.

Osborn can help you be that low-cost foundry by bringing you an accumulation of the finest machine-moulding and core-making practices in America. *NOW* is the time to study them. This service is yours without obligation.

THE OSBORN MANUFACTURING COMPANY

5401 Hamilton Avenue *Cleveland, Ohio*

OSBORN

MOULDING MACHINES

Exceptional HEAT UNIFORMITY

...with MAEHLER ovens...

. . . mean more uniformly baked cores

RECENT TESTS SHOW . . . temperature variations of only 5°

100% Maehler Core Ovens at Howard Foundries

View above shows 8 of the many Maehler ovens at Howard magnesium, aluminum and bronze foundries. There are two racks in each compartment — 24 racks in all. One gas-fired Maehler air heater for each double oven. L & N and Wheelco controls and automatic dampers (a new Maehler development) for each heater.

MAEHLER'S leadership in developing the recirculating air heat system for industrial ovens has resulted in a line of equipment that gives heat uniformity that is virtually *perfect!* Recent tests show that a Maehler oven operating at 500°F fully loaded maintained a heat uniformity within 5°, through high volume and rapid air heat circulation and highest grade instruments. This kind of temperature control means uniform baking . . . no under-baked nor over-baked cores.

Maehler core and mold ovens are available in a complete range of oil fired, gas fired and electrically heated units, incorporating the Maehler recirculating principle for high uniformity and output, at low cost.

Let us quote you on your requirements.

THE PAUL MAEHLER COMPANY
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A Few Users of
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GREENLEE BROS.
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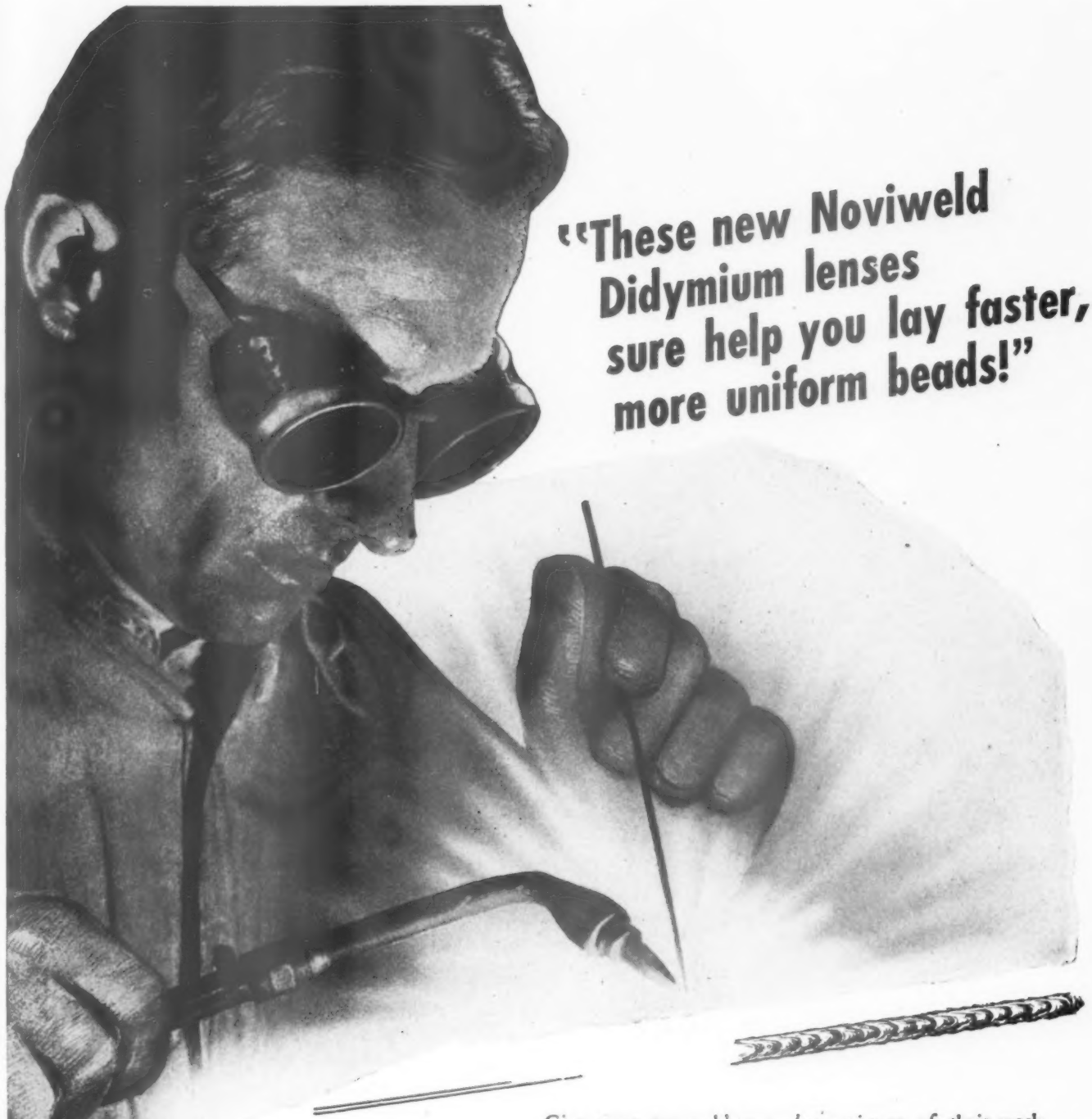
HOWARD FOUNDRIES

MAEHLER

Industrial Ovens and Furnaces for Core Baking, Mold Drying, Heat Treating, Enameling, etc.

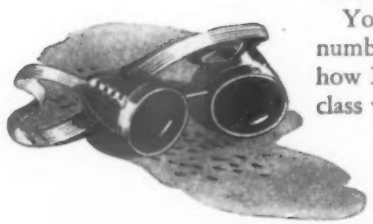


"These new Noviweld Didymium lenses sure help you lay faster, more uniform beads!"

Give your gas welders a *clearer* picture of their work . . . with Noviweld-Didymium lenses. These lenses screen out "sodium flare" while *preserving* orange and red color values. They let your welders see the rod and bead clearly — remove any guessing — give them a better view of the whole working area.

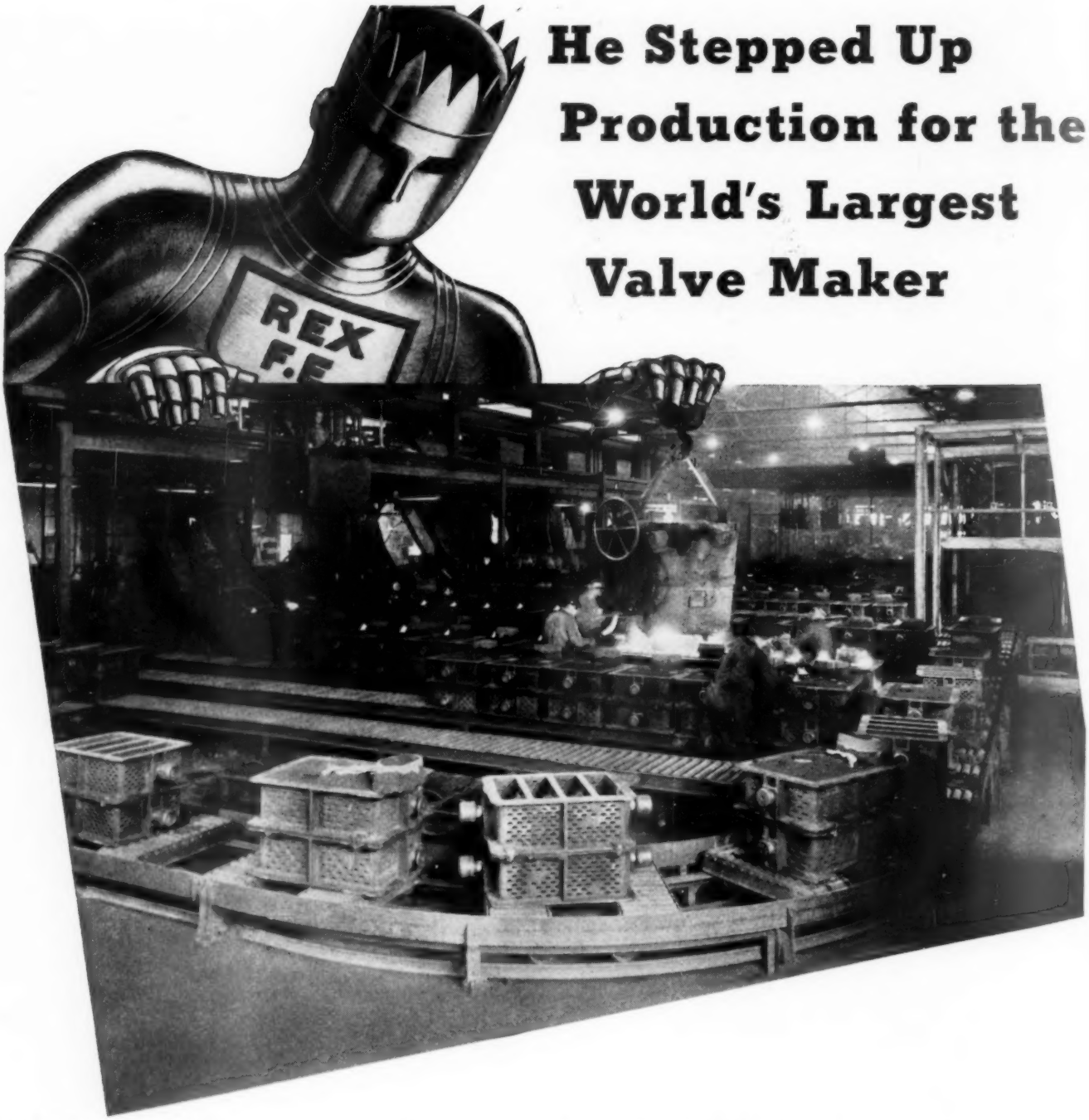
Many who have tested Noviweld-Didymium lenses consider them to be the best welding lenses yet developed. Today, they are bringing clearer vision to thousands of needed "production eyes". And clearer vision means *quicker* vision, faster work!

You can get immediate delivery of Noviweld-Didymium lenses in shade numbers 3, 4, 5, and 6. Your AO Safety Representative will gladly show you how Noviweld-Didymium can help your flame welders and burners do higher class work rapidly, accurately. Ask him for a demonstration *now*.



American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS

He Stepped Up Production for the World's Largest Valve Maker



VALVES ARE VITAL to a nation at war, and to keep pace with the stepped-up wartime demand, valve production had to be greatly increased.

Called in to help increase the capacity of the world's largest maker of valves, Rex Foundry Engineering . . . Rex F. E. . . . knew that the best way to accomplish this would be to modernize the handling system. For, through his many years of experience in solving foundry problems, Rex F. E. knew that no other single factor is more directly responsible for operating efficiency than the right method of handling sand, molds and castings.

He and his staff of experienced foundry engineers designed a new, completely modern handling system. From the time the molding sand starts its journey to the foundry floor until the hot castings are shaken out, every operation is handled on an efficient Rex conveyor system that has greatly increased production capacity and at the same time released thousands of man-hours for other vital production.

* * *

Rex F. E. and his staff of foundry trained engineers are always at your service . . . to help you design and install the best system for your foundry. For complete information, write Chain Belt Company, 1671 West Bruce Street, Milwaukee 4, Wisconsin.

REX **FOUNDRY HANDLING SYSTEMS**

CHAIN BELT COMPANY OF MILWAUKEE

Character in CORE OILS

LINBOND

Uniformity—the priceless quality in core oil—is an outstanding characteristic of LINBOND. Thus LINBOND Core Oils, which are graded for tensile strength and then identified by separate number, can be depended upon to give consistent results, and by reducing core losses, plus a favorable first price, bring costs to a new low figure. LINBOND Nos. 600 and 700 series rate with pure linseed oil.

LINBOND is extremely flexible in performance, clean to work with, will serve for a wide range of baking temperatures and has proven adaptable for malleable, gray iron or the nonferrous field.

KORBOND

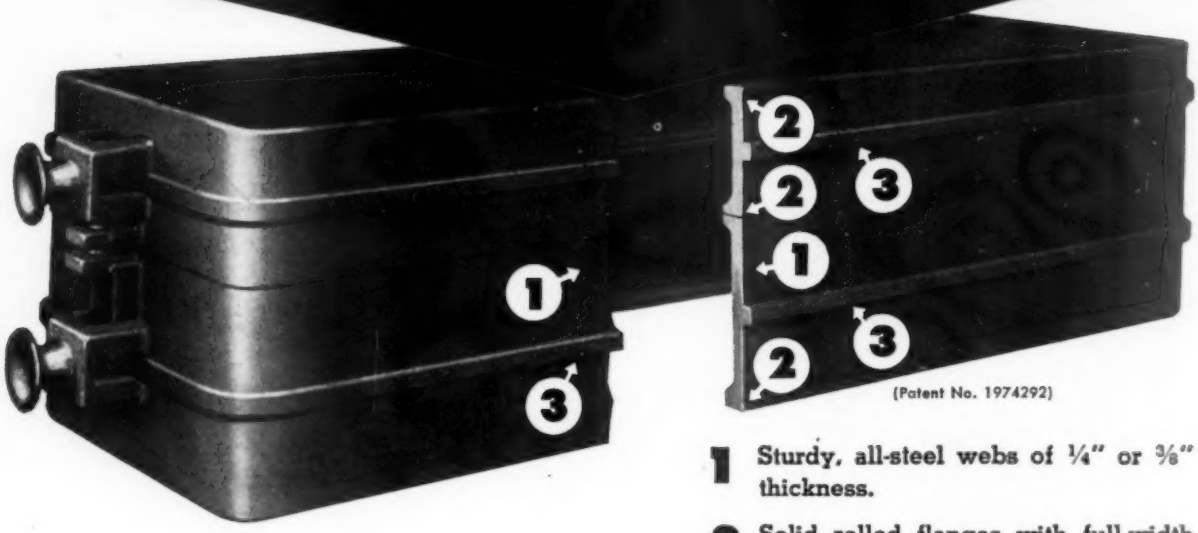
For more particular work or where oven conditions are unfavorable—where heat runs high or time in the oven cannot be controlled, try KORBOND. ALL KORBOND oils numbered in the 700 and 800 series are on the high side of linseed for strength and for cores where thin sections must be formed without the use of rods or wires or for nickel steel castings, KORBOND does the job with less oil and as a result less gas results in the pouring.

There is a grade of KORBOND for every requirement and we pride ourselves that each grade is controlled in production so that every shipment is complete and exactly as specified. Try KORBOND once in production and you'll rely on it for your quality standard.

UNITED OIL MFG. CO.

1429 WALNUT STREET,
ERIE, PENNSYLVANIA

Sterling GIVES YOU SOLID Construction!



(Patent No. 1974292)

1 Sturdy, all-steel webs of ¼" or ⅜" thickness.

2 Solid rolled flanges with full-width bearing.

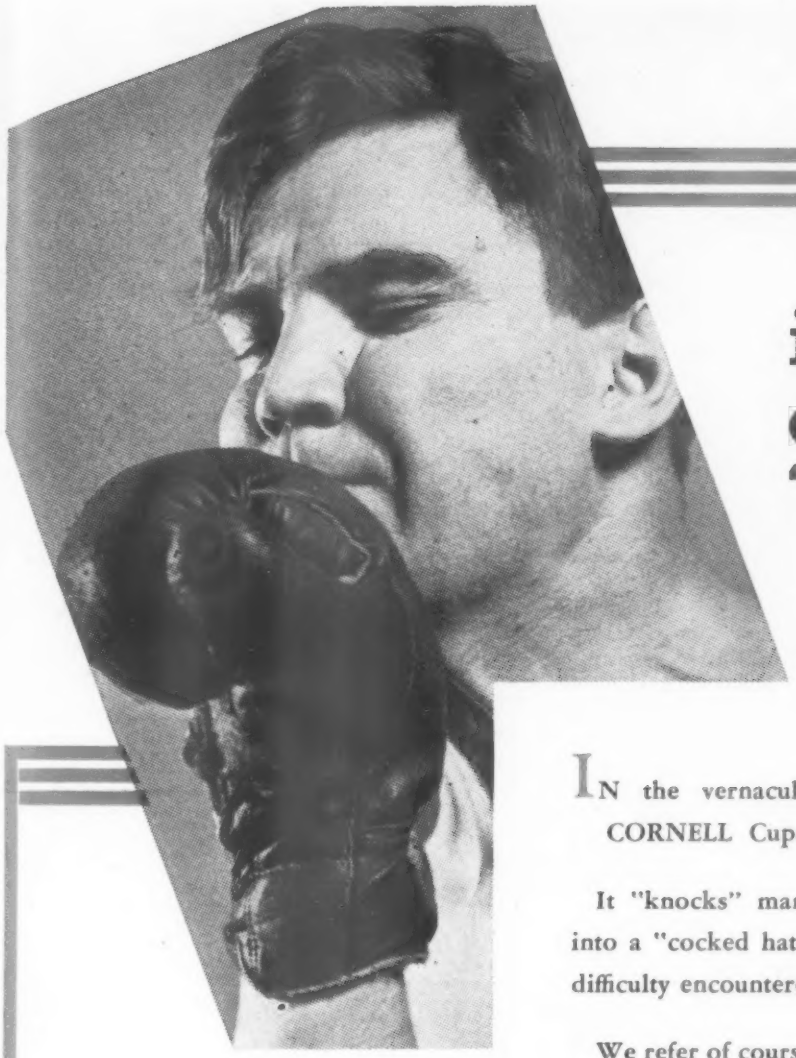
3 Husky, solid center reinforcing bars.

Sterling LIFETIME Foundry Flasks have long proven their practical combination of maximum strength with minimum weight. The cut-away view, shown above, tells the story. Note the husky rolled channel steel construction . . . the solid center reinforcing bars . . . the thick flanges with square corners and full-width bearing. Frankly, can you think of any other foundry flask that offers such SOLID construction?

Sterling FOUNDRY FLASKS

STERLING WHEELBARROW COMPANY · MILWAUKEE, WIS., U. S. A.

A 4334-1P



it's a "knockout"

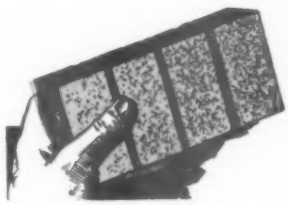
IN the vernacular of the prize ring Famous CORNELL Cupola Flux is truly a "knockout."

It "knocks" many of the foundryman's troubles into a "cocked hat" by relieving him of a common difficulty encountered in connection with his "melt".

We refer of course, to the slag and other impurities inherent in all iron and present today in abnormal quantities due to the use of extra large proportions of dirty scrap.

The solution lies in making this slag and other impurities "fluid" that they may run freely out of the slag hole. The result is a purer, more fluid iron the many valuable features of which are known to every foundryman.

If you are not using Famous CORNELL Cupola Flux isn't it time to put it to work for you? If you do so and use it consistently we predict that you too will say yes, "it's a knockout."



FAMOUS CORNELL FLUX

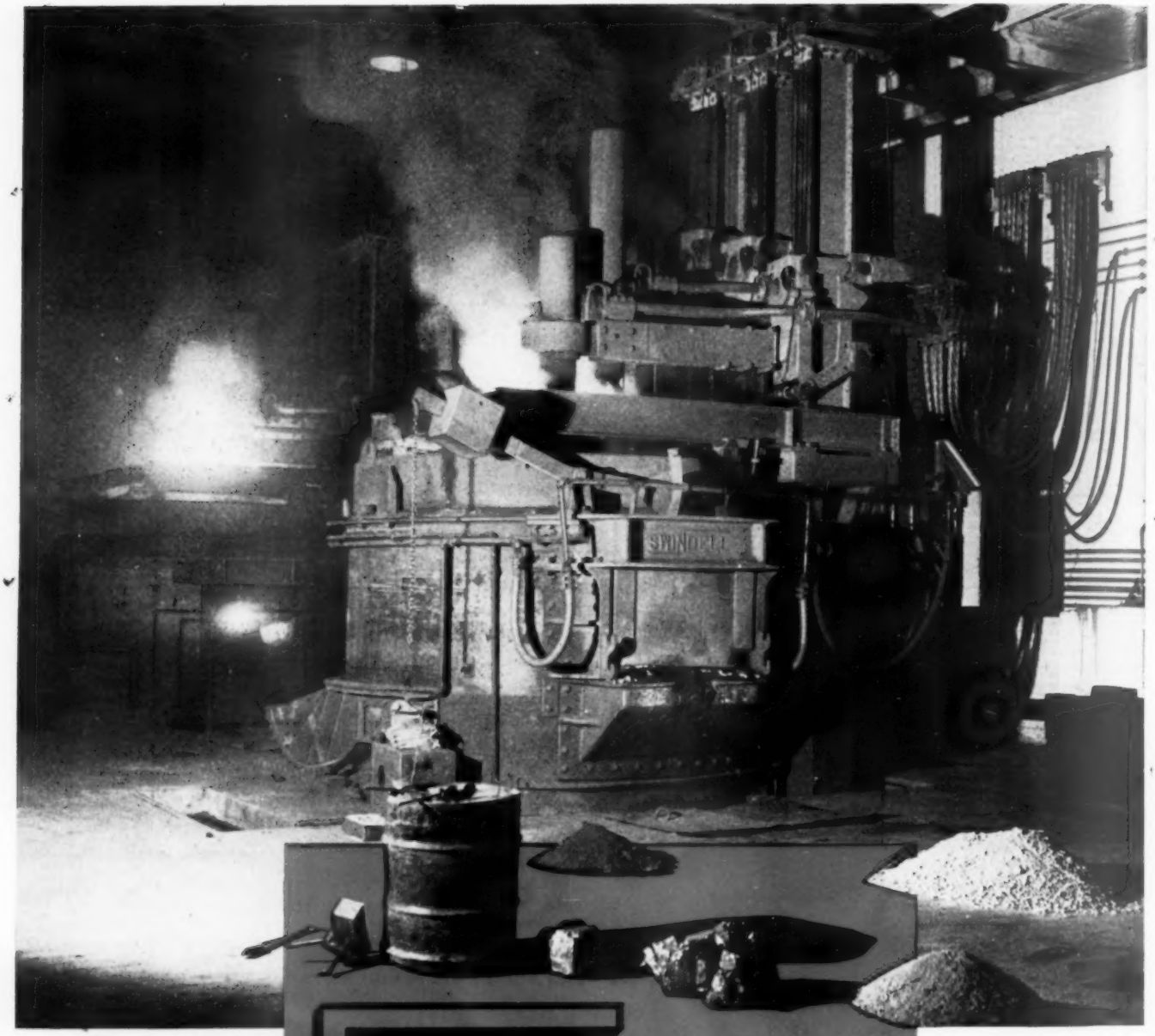
Symbolizing the best in foundry flux are this hand and brick recognized by leading foundrymen for over 25 years.

The CLEVELAND FLUX *Co.*

Manufacturers of Iron, Brass and Aluminum Flux Since 1918

1026-36 Main Ave., N. W.

CLEVELAND, OHIO



SWINDELL

electric arc melting furnaces

Bringing to the rapid war production of steel every *performance advantage* including

TOP CHARGING • SWINGING ROOF
4-POINT ROOF SUSPENSION

INTEGRATED CONSTRUCTION OF ROOF OPERATING MECHANISM

LET US CONSULT WITH YOU!

SWINDELL-DRESSLER *Corporation*

DESIGNERS AND BUILDERS OF MODERN INDUSTRIAL FURNACES

PITTSBURGH, PA.

CONSERVE ALLOYS by Using "EM" Briquets for Additions of Chromium, Manganese, and Silicon

UNUSUALLY high recoveries are obtained when "EM" Ferro-alloy Briquets are used to add the alloying elements to cast iron in the cupola. With good practice, uniform recoveries are obtained which average 90 per cent of the silicon, 85 per cent of the manganese, and 90 to 95 per cent of the chromium, when these elements are added in the form of "EM" Briquets. The uniformly high recoveries give the foundryman close control over the composition of the iron.

"EM" Briquets are made with a special binding material which has a higher melting point than the ferro-alloys. This binder protects them on the way to the melting zone so that there is no excessive loss through oxidation. In the melting zone the ferro-alloys melt and dissolve in the molten iron in the hearth, and the binder disappears in the slag.

"EM" Briquets are convenient to use because they contain a definite amount—either one or two pounds—of the alloying element, and because they can be identified by their shape. They are handy to use because they eliminate the necessity of breaking lump ferro-alloys to get an exact number of pounds for the alloy addition.

Because of the effective results obtained by adding molten alloys to the iron in the hearth, "EM" Briquets make possible the use of a high percentage of inferior scrap. The close control possible when alloy additions are made with "EM" Briquets results in few rejected castings and great flexibility in cupola operation.

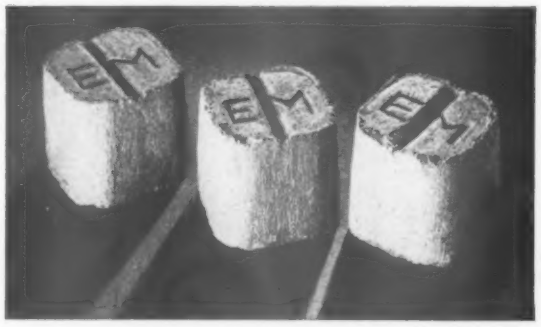
For further information about the use of "EM" Briquets, write for the book, "Briquetted Alloys for the Cast Iron Foundry."

"Electromet" Ferro-Alloys and Metals are distributed through offices of Electro Metallurgical Sales Corporation in Birmingham, Chicago, Cleveland, Detroit, New York, Pittsburgh, and San Francisco. In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario.

Sizes and Shapes of "EM" Briquets

SILICON — "EM" Silicon Briquets are cylindrical. The large and small sizes contain 2 lb. and 1 lb. of silicon respectively.

CHROMIUM — "EM" Chromium Briquets are hexagonal and contain exactly 2 lb. of chromium.



SILICOMANGANESE—"EM" Silicomanganese Briquets can be identified by their square shape. Each contains 2 lb. of manganese and ½ lb. of silicon.

Electromet
Trade Mark
Ferro-Alloys & Metals

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York, N. Y.

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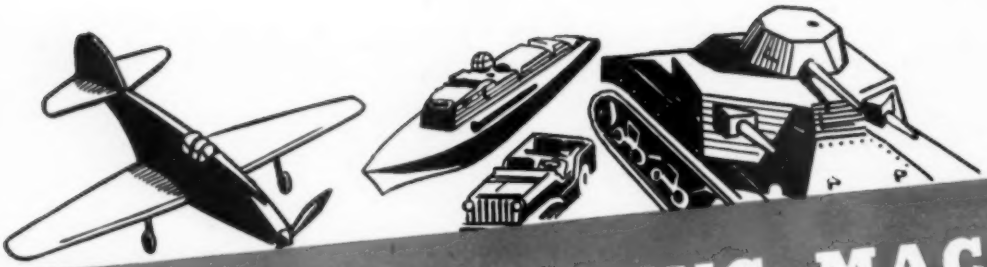
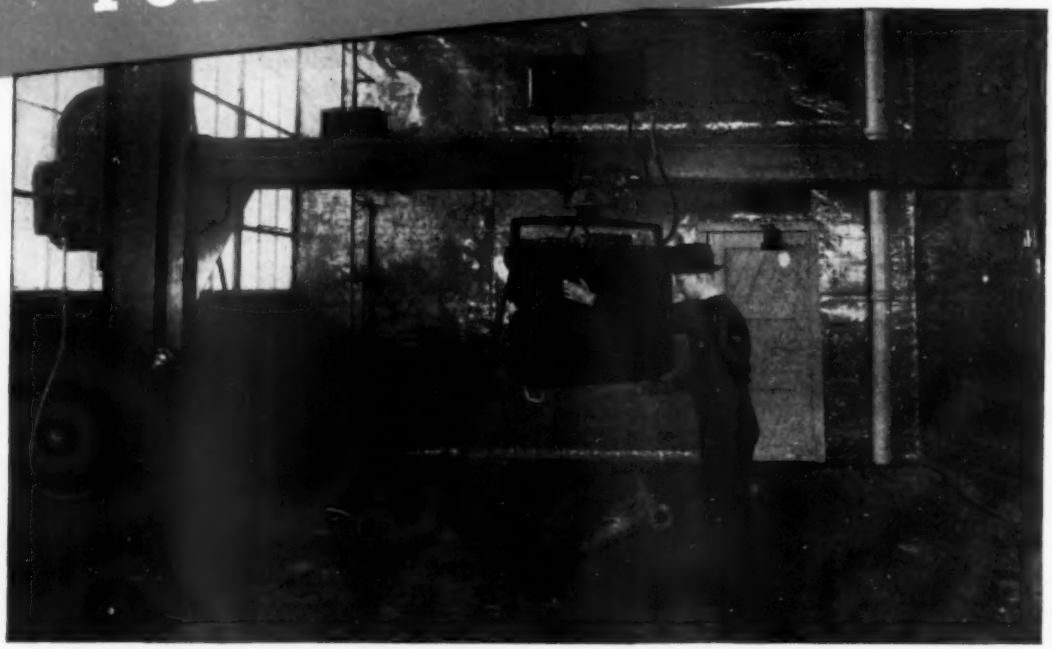
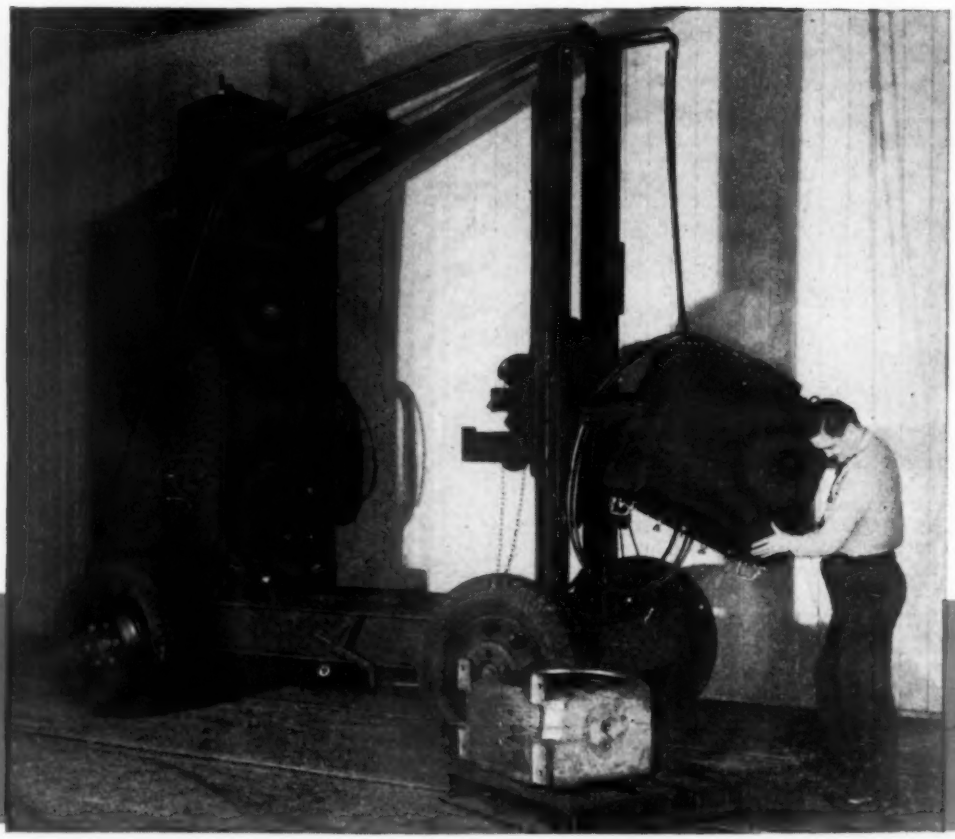


FOR FIGHTING MACHINES ..



G-E Motor Operated Vertical Travel Stationary Jib Crane Unit



G-E Mobile Jib Crane Unit

WHERE ENDURANCE COUNTS..

G-E X-Ray Units Check Inside Strength at War Production Speed

There's no argument—America's fighting machines must be built to endure. Every possible weakness must be checked and eliminated. And fast. The result must be tough, equipment built in the shortest possible time, and with the smallest possible waste—a minimum of rejects. That's where x-ray comes in.

X-ray examination can assure improved welds and castings—castings that will measure up to the high standards demanded in war time production, welds that will withstand severe shock and stress. For with x-ray, it is possible to "see inside"—to examine the interior structure and not only find hidden faults, but study their location and character so that they may be avoided in the future.

Yes, x-ray has found many wartime jobs in industry, and G-E X-Ray units—with transformers, tubes, controls, and mountings all designed expressly for industrial service—are doing the great majority of those jobs.

An ideal unit for use on castings and weld work where widely varying radiographic positions require frequent changes in the vertical height of the x-ray tube head is the G-E Motor-Operated Jib Crane Unit with either G-E Model OX-200 (200,000-volt) or G-E OX-250 (250,000-volt) x-ray apparatus. Its wide range of vertical and horizontal travel and the degree of angulation and rotation of the tube head makes positioning an easy accurate procedure.

Also available with the OX-200 or the OX-250 is the G-E Mobile Jib Crane Unit. Mounted on a pneumatic-tires chassis it can be moved easily to any large inspection job. This unit also provides an unusual degree of flexibility and permits fast, exact positioning for practically all types of radiographic inspection.

For weld shops not equipped with concrete or other smooth floors, G-E X-Ray designed the Flange-Wheel Truck Unit, for use with the G-E Model OX-200 or the OX-250.

For the complete story about G-E Industrial X-Ray Units or if you wish the services of a G-E Industrial X-Ray Engineer, write or wire, today; to General Electric X-Ray Corporation, 2012 Jackson Boulevard, Chicago 12, Illinois; Department N 33.

G-E Flange-Wheel Truck Unit

Today's Best Buy — U. S. War Bonds

GENERAL ELECTRIC X-RAY CORPORATION

The 12"-38" Adams Jolt Squeezer, Portable Type

Now, as never before, you need—
Adams Jolt Squeezers

To maintain production in the face of a skilled labor shortage, it is necessary to make full use of modern equipment and processes, in order to transfer skill from man to machine as much as possible.

Adams Jolt Squeezers help to smooth out your skilled labor problem. They are so simple in design and so convenient to handle that no special skill is needed to operate them successfully.

There are sizes and types to fit any requirement of squeezer molding—Side Rod Type and Post Type—Jolt Squeeze and Jolt-Squeeze-Pattern-Draw-Styles — Stationary and Portable.

Catalog No. 705 contains full details. Do you have a copy?

The Adams Company,

700 FOSTER STREET
DUBUQUE, IOWA

1883 — *Our 61st Year* — 1944

MOLDING MACHINES **ADAMS** **FLASK EQUIPMENT**

Lower Cost—Easier Operation

Electric Melting enters a new era of usefulness because of developments incorporated in Hydro-Arc Furnaces

Hydro-Arc Electric Furnaces employ a hydraulic system for positioning electrodes, thus eliminating the "give" and "stretch" of steel cables. The result is an instantaneous, accurate response of the electrodes to whatever movement is called for by the control system—with minimized overtravel and "hunting."

The benefits of hydraulic positioning are many... less electrode dipping and carbon pick-up—lower electrode consumption—less surging of the transformer, minimizing transformer heating—better power factor—and important savings in energy cost.

Hydro-Arc Furnaces are built so that electrode clamps may be operated from the floor. This feature saves climbing over the hot furnace to slip electrodes—the most disagreeable and dangerous task formerly associated with electric furnace operation.

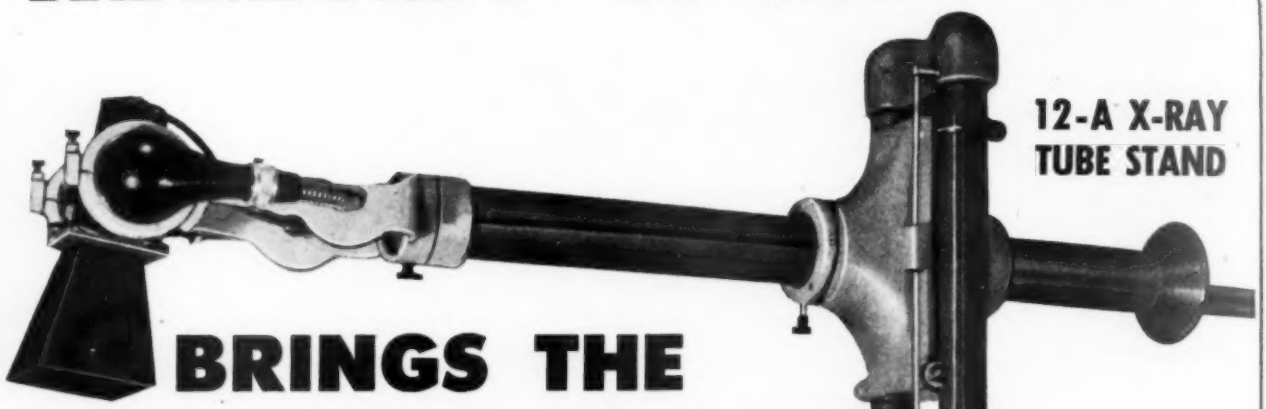
WRITE for further information concerning important innovations in electric furnace construction and operation. Whiting Corporation, Hydro-Arc Electric Furnace Division, 15607 Lathrop Ave., Harvey, Illinois.

WHITING

HYDRO-ARC ELECTRIC FURNACES

KELEKET X-RAY

ARMY E NAVY



12-A X-RAY TUBE STAND

BRINGS THE WORK INTO RANGE

THE TUBE GOES BACK AND FORTH
UP AND DOWN
AROUND IN A CIRCLE

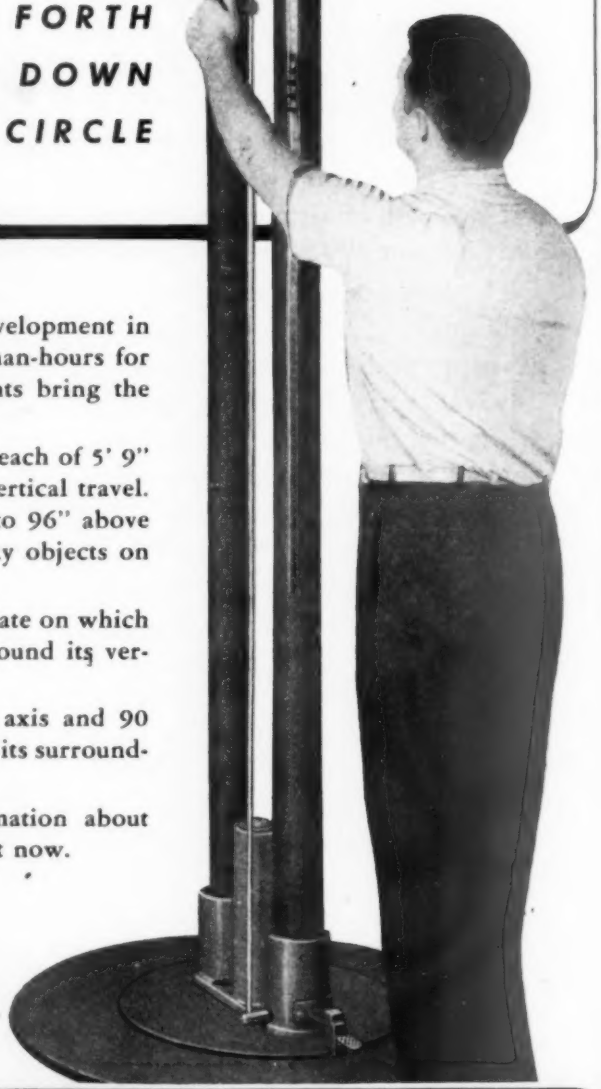
THIS versatile KELEKET X-ray unit is a new development in the X-ray industrial field. Its great range saves man-hours for positioning the objects—and its universal adjustments bring the most inaccessible parts within radiographic reach.

The swinging arm of this X-ray tube stand has a reach of 5' 9" and moves on a ball-bearing carriage with six-foot vertical travel. Target to film distance may be anywhere from 24" to 96" above the floor, allowing ample space for positioning bulky objects on floor, bench or table.

The twin columns are mounted on a ball-bearing plate on which the entire unit may be rotated a full 360 degrees around its vertical axis.

The tube itself, turning 360 degrees on its long axis and 90 degrees on its short axis, can be set at any angle within its surrounding sphere to reach hard-to-get-at parts.

Our special Bulletin F-12 gives complete information about this new contribution to industrial X-ray. Write for it now.



KELLEY-KOETT X-RAY MFG. COMPANY
2273 WEST FOURTH ST., COVINGTON, KY

PIONEER CREATORS OF *QUALITY* X-RAY EQUIPMENT SINCE 1900

Penolyn Core Oil means FEWER REJECTS

Because war production starts in the foundry, every foundry delay holds up production all along the line. But production is roaring ahead faster than ever—for American foundries just aren't causing delays. They're turning out perfect castings at "assembly line" tempo—with rejects cut to rock bottom figures.

Penolyn Core Oil is helping here—by increasing the number of perfect cores and perfect castings. This 100% dependable core oil binds hard, bakes fast, cleans quickly, and holds gas-forming tendencies to a minimum. And there's a Penola engineer on call whenever you need his help!

PITTSBURGH, PA.

Penola
Reg. U.S. Pat. Off.

NEW YORK
CHICAGO
DETROIT
ST. LOUIS

How Do YOU Dry BIG Molds?

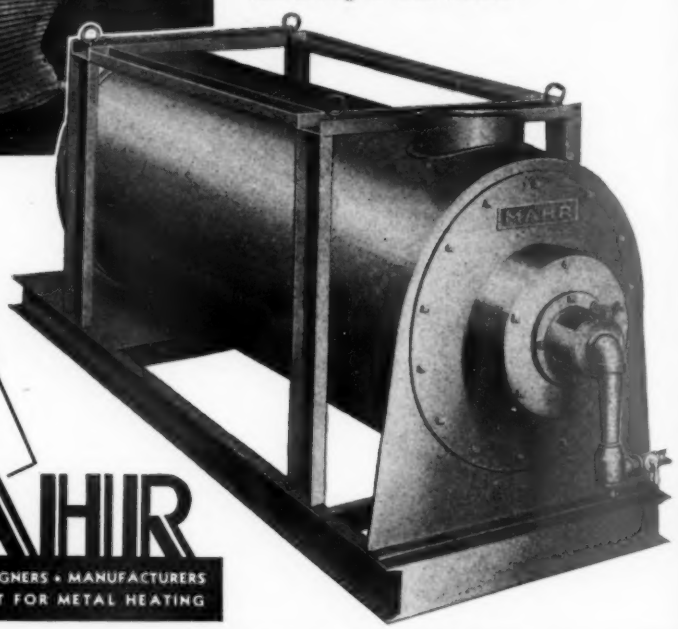
Here's How One Foundry Cut Drying Time from 45—50 Hours to 18!

This huge mold will make a 20,000 lb. casting for a marine motor base. If dried in an oven in the usual way, it would take 45 to 50 hours. With two MAHR Portable Mold Dryers on the job, as shown in illustration at left, the mold was ready for pouring in only 18 hours! That's a big step toward "beating the promise" on delivery—and a real saving in Man Hours.

ANOTHER FOUNDRY SAYS...

LYNCHBURG FOUNDRY CO.
Lynchburg, Va.

"We are using the MAHR Portable Mold Dryer in drying the mold of low pressure cylinder castings, which castings are ultimately used on our Victory ships. Our old method of drying these molds was to put the entire mold on an oven car, put the car in the oven and dry the mold from 36 to 48 hours. With the mold dryer we are able to leave the molds on the foundry floor and dry them in an average time of 18.2 hours. We like this unit so well that we have ordered another one from you which we are very anxious to receive."



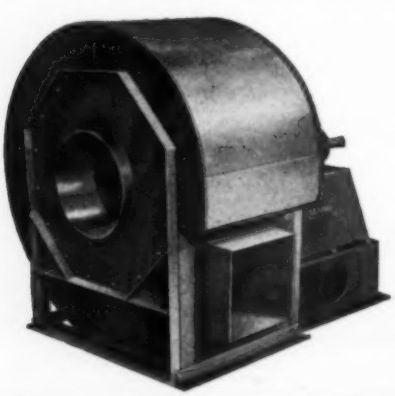
MAHR
ENGINEERS • DESIGNERS • MANUFACTURERS
ALL EQUIPMENT FOR METAL HEATING

OIL OR GAS FIRED Portable MOLD DRYER

There are many reasons for the sensational performance of this modern MAHR unit. It dries from the inside out,—the sand is baked only to the depth needed from the core. All the sand does not have to be baked through from the outside in. Shake-out is easy, and sand does not necessarily have to be reconditioned after each casting.

Heat-up time is extremely fast. Large volumes of hot gases are forced into every part of the mold for fast, complete drying. Normal drying times are radically shortened.

The entire unit is mounted on a heavy channel steel frame, and can be quickly moved and set up for use on any large mold. Fuel may be either gas or oil. Economy in operation is one of its features because of rapid and complete combustion. Made in 4 sizes—250,000—500,000—750,000—1,250,000 BTU capacity.



MAHR Temperature Fans

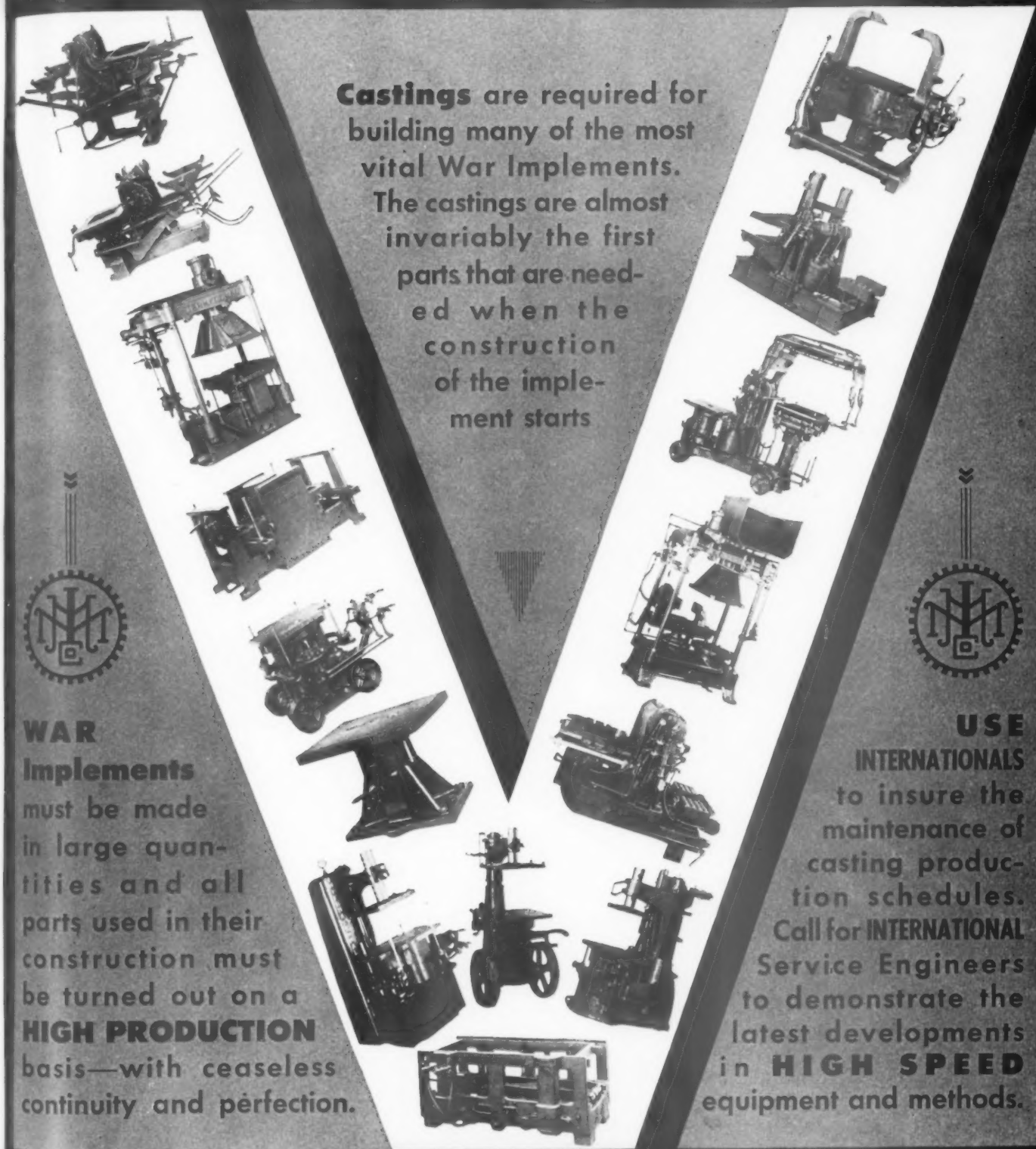
When your recirculating fans on core ovens, heat treating furnaces and other high temperature applications "pass out" on you long before they should—perhaps you get a little hot yourself and say,—"Why doesn't somebody build a fan to stand up to this kind of work?" That's EXACTLY what MAHR has done! MAHR Temperature Fans were designed and built for recirculating hot gases in our own heat treating furnaces—and for that purpose only. No adapting or remodeling, but a rugged, efficient, high temperature fan for work from 800° F. to 1500° F.—and it really does a job! Many exclusive features. 10 sizes, 800 to 40,000 cfm.

WRITE FOR BULLETINS—on MAHR Portable Mold Dryer—Bulletin 1050. On MAHR Temperature Fans—Bulletin 1070. Or get the whole story from any MAHR representative.

Sales Offices in Principal Cities

MAHR MANUFACTURING CO.
DIVISION OF DIAMOND IRON WORKS, INC.
1709 NORTH SECOND ST. MINNEAPOLIS 11, MINN.

NTERNATIONAL MOLDING MACHINES



Castings are required for building many of the most vital War Implements. The castings are almost invariably the first parts that are needed when the construction of the implement starts

WAR Implements must be made in large quantities and all parts used in their construction must be turned out on a **HIGH PRODUCTION** basis—with ceaseless continuity and perfection.

USE INTERNATIONALS to insure the maintenance of casting production schedules. Call for **INTERNATIONAL** Service Engineers to demonstrate the latest developments in **HIGH SPEED** equipment and methods.

NTERNATIONAL MOLDING MACHINE CO.

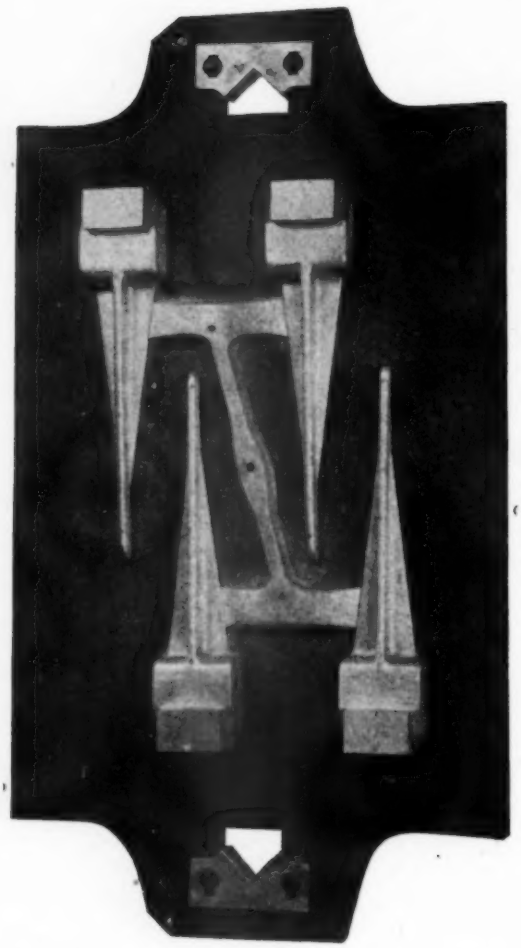
08-2624 W. 16th STREET · CHICAGO, ILLINOIS

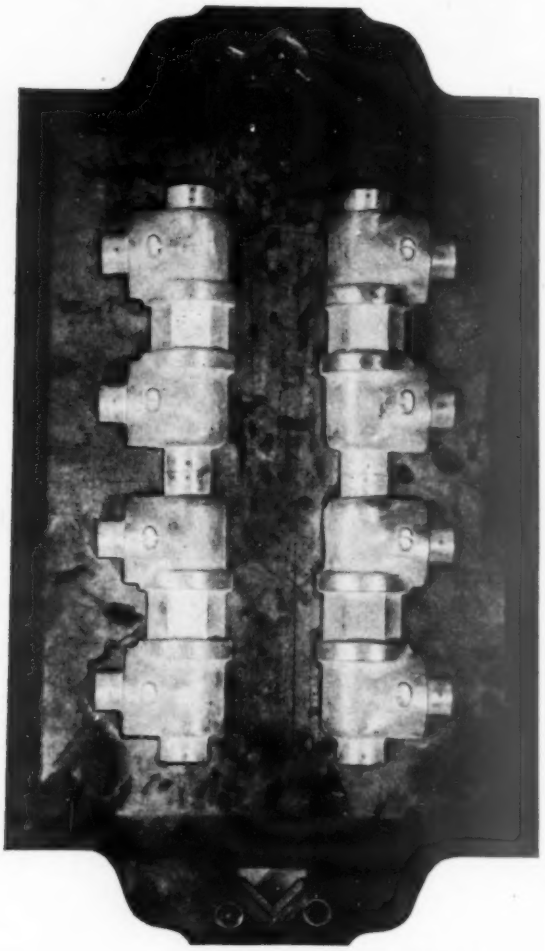
LIGNOLITE

NON CRITICAL

PATTERN PLATES

IMMEDIATE SHIPMENT





- FLAT
- UNIFORM CALIPER
- LIGHT WEIGHT
- HIGH STRENGTH
- EASILY MACHINED
- MOISTURE RESISTANT

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BARADA & PAGE, INC.
2812 Center Street, Houston, Texas

M. A. BELL COMPANY
217 Lombard Street, St. Louis, Missouri

COMBINED SUPPLY & EQUIPMENT CO., INC.
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FREEMAN SUPPLY CO.
1152 E. Broadway, Toledo, Ohio

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2144 E. 7th Street, Los Angeles, California

GEORGE F. PETTINOS, INC.
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WESTERN FOUNDRY SAND CO.
1039 Elliott Avenue West, Seattle, Wash.

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GEORGE F. PETTINOS, (CANADA) LTD.
42 James Street, South Hamilton, Ont.

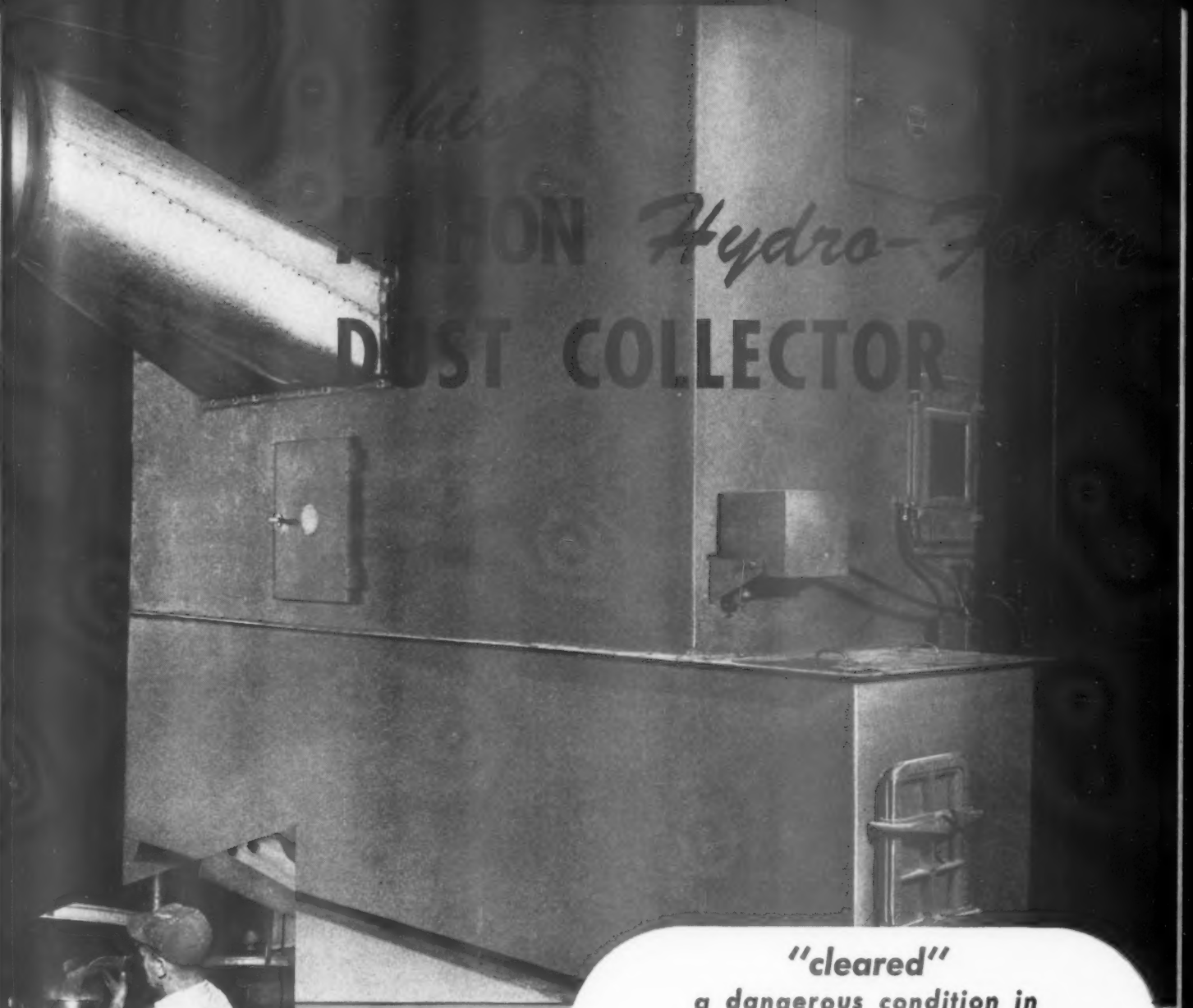
STANDARD SIZES—HOW TO ORDER

Available in all flask sizes, 3/8" to 2" thick. Standard plates are octagonal in shape with 1" allowance for flask and 2 1/2" allowance for ears. Sheets are also available for own cutting. Sizes are 46" x 46" for thicknesses from 3/8" to 1 1/2" inclusive; 40" x 40" for thicknesses over 1 1/2". Please write for sample and complete information.

MARATHON CHEMICAL COMPANY

DIVISION OF MARATHON PAPER MILLS COMPANY

ROTHSCHILD WISCONSIN



plastic compound is poured
ppers of these moulding ma-
, the dust is drawn away from
ers through circular openings
heads above.

pellets from moulding ma-
are transformed into buttons
tremendous pressure. Dust
agitators is drawn into ducts
ing to Collector. Operators
e clean air.

"cleared"

a dangerous condition in the making of plastic buttons

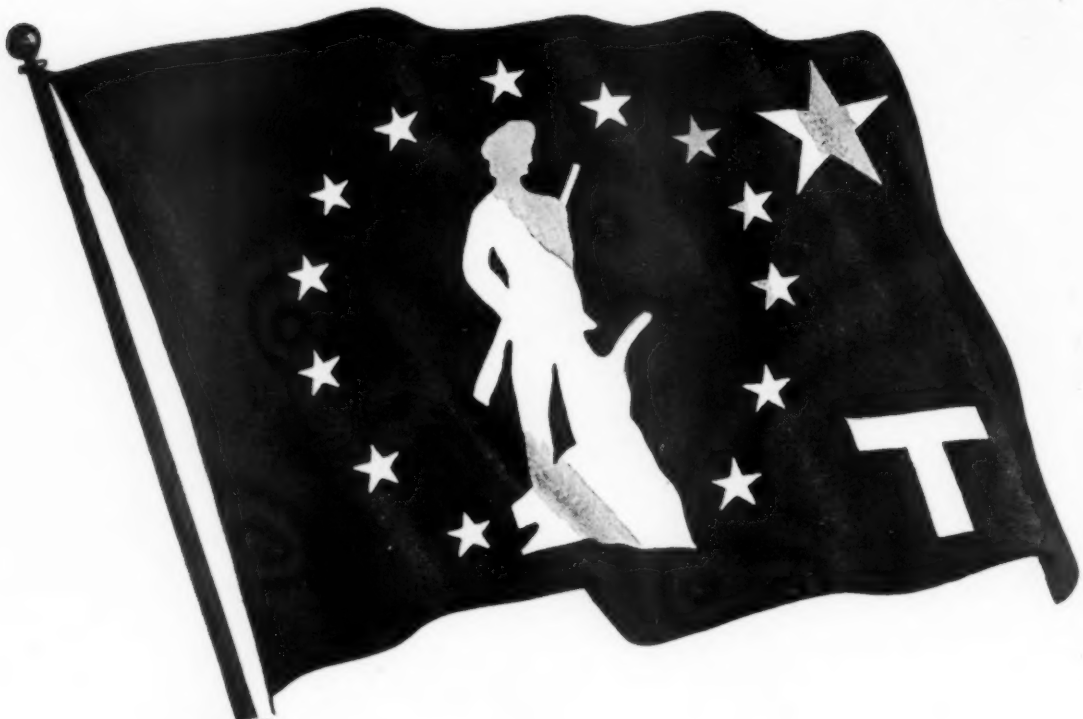
Many of the buttons used in making uniforms for the armed services are moulded under pressure, from a plastic compound. In powder form, this compound is unusually fine and permeating. It tends to "float" throughout the entire working area in which it is released—a dangerous menace to men and machines. Installation of a Mahon *Hydro-Foam* Dust Collecting System for this manufacturer disposed of the hazard completely. Not only does the installation now keep working areas free of this dangerous dust—it also serves as an especially effective ventilating system for the entire plant. Operation is practically noiseless. Equally as spectacular results are being accomplished in many other industries.

Dispose of dust the SAFE way—deposit it under water

THE R. C. MAHON COMPANY

DETROIT — CHICAGO

Manufacturers of Metal Cleaning Machines • Rust Proofing Machines • Hydro-Filter Spray Booths • Ovens of All Types • Filtered Air Supply Units • Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing Systems



Congratulations

ON A FINE JOB, WELL DONE!

THE Treasury "Star" Flag—the bond-buying counterpart of the Army-Navy "E"—marks plants with at least 90% of personnel participating in the Payroll Savings Plan to at least 10% of gross payroll, *and also having reached, or topped, a War Loan Drive quota!*

The successful close of the 4th War Loan Drive finds many more "Star" Flags than ever before flying over the industrial plants of America. To all these, go the heartiest thanks of the nation, and the deep appreciation of the Treasury Department for a great job! And to those who may not quite have qualified for the "Star," go equally sincere thanks—and the confidence that soon they, too, will join the ranks of the "Star" fliers.

One thought that many concerns have found helpful in stepping up the intake from their Payroll Savings Plans is this. In many cases the Treasury Representative in a plant has been able to point out the fact that during *Loan Drive periods* the employees have found it possible to spare much more than they had counted on when setting up their original subscription, and that—*when properly approached*—a very substantial fraction of such employees will decide they can well afford a distinct increase in their current Payroll Savings Plan.

Talk this over with your Treasury Representative—it offers important possibilities when correctly handled. And again accept the Treasury Department's congratulations for your fine work in helping to put over the 4th War Loan.

LET'S **ALL** KEEP
BACKING THE ATTACK
WITH **WAR BONDS**

The Treasury Department acknowledges with appreciation the publication of this message by

THE FOUNDRY

This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council.

Announcement

NORTON GRINDING WHEELS OF

*57 ALUNDUM ABRASIVE now available to everybody

DEVELOPED by Norton research several years ago, 57 Alundum abrasive was an immediate and outstanding success in wheels for cylindrical, centerless and internal grinding. Limited production facilities, however, made it necessary to restrict the use of the new wheels to those critical war jobs for which their characteristics were most needed.

Now increased production capacity makes it possible to offer Norton grinding wheels of 57 Alundum abrasive for all jobs.

57 Alundum abrasive combines the fast, cool cutting action typical of 38 Alundum abrasive with the durability and toughness of regular Alundum. Thus these new Norton wheels stay sharp longer and hold their shape better. Dressings are few and heavy cuts without burning are possible.

Your Norton abrasive engineer will be glad to tell you just where 57 Alundum grinding wheels will help you.

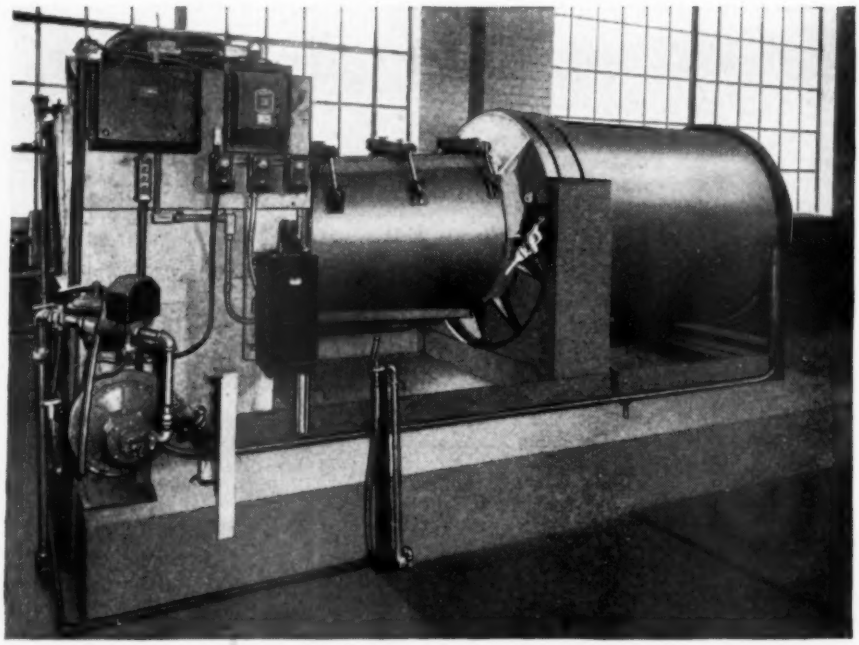
NORTON COMPANY, WORCESTER 6, MASS.

W-954

NORTON ABRASIVES

Ransohoff Automatic Star-return WET CLEANING MILLS

Clean Large or Small Castings in the Same Mill



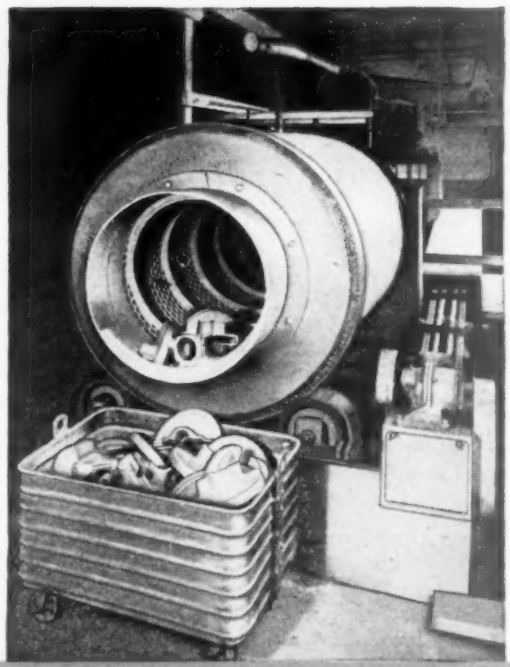
OLD-FASHIONED methods and inadequate equipment won't do! You can't run a business in the 1944 manner with the tremendous demands on time and machinery unless you are equipped efficiently.

RANSOHOFF
WET CLEANING MILLS

speedy • gentle
economical
not self-destructive
automatic handling
of stars

SEND US A SAMPLE BATCH
Get the recommendations of the
RANSOHOFF ENGINEERS

SAVE 30% to 70% ON YOUR CLEANING COSTS



Two views of a Ransohoff side-loading, end-unloading wet mill cleaning miscellaneous grey iron castings. Loading is done thru a door in the side. Small work is dumped in. Large or fragile work is packed into the drum, loaded and unloaded from the side. Small work is unloaded automatically from end of mill as illustrated.

- **Stars fill all voids completely. Very rapid cleaning results without nicking, breaking or mill wear. Wet method eliminates health hazards and dust collectors.**

N. RANSOHOFF, Inc. CINCINNATI, OHIO
Township Ave. and Big 4 R. R.

ALUMINUM LIVES TO FIGHT AGAIN!

The tide of battle rolls on . . . leaving in its wake a twisted pile of ruined metal. Here was once an army truck moving supplies to the front. Now it is another casualty of war . . . a useless heap of molten metal.

Yet not useless . . . for the aluminum in that truck will be re-alloyed to strike still another blow at the axis. It will be reincarnated by the miracles of modern alloying into a good-as-new metal . . . an aluminum alloy that will meet the government's rigid specifications for quality and strength. It will live again and form, perhaps, the mighty cylinder head for a new jeep.

Yes, aluminum never says die . . . our aluminum alloys live to fight again.

Aluminum and Magnesium, Inc.
Sandusky, Ohio

The American Metal Company, Limited
New York City

Apex Smelting Co.
Chicago, Illinois

The Cleveland Electro Metals Co.
Cleveland, Ohio

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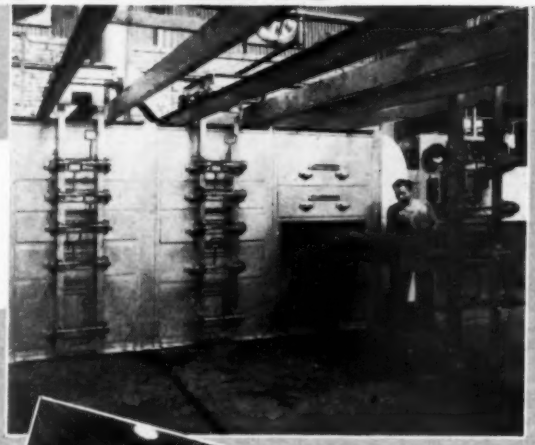
East Chicago, Indiana

ALUMINUM RESEARCH INSTITUTE

111 West Washington Street, Chicago 2, Illinois

COLEMAN OVENS -- Every Type



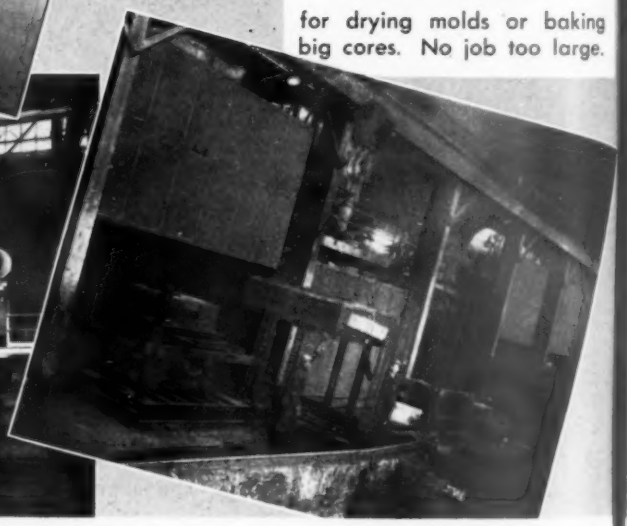
COLEMAN
ROLLING DRAWER OVENS
For speedy baking of small and medium cores.

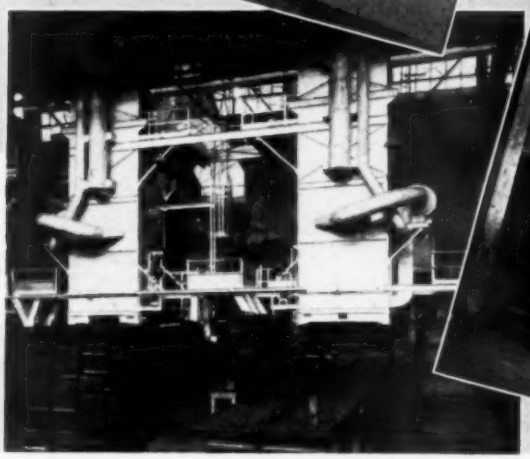
COLEMAN
TRANSRACK OVENS
for operation with portable racks. Single or multiple rack capacity.

THE complete range of Coleman Ovens, in all types and sizes, and the engineering know-how gained by 40 years' experience and over 8,000 successful installations, are your positive assurance of obtaining the right ovens for your particular job.

Coleman Ovens are backed by a complete guaranteed service with undivided responsibility, from design to operation.

COLEMAN
CAR TYPE OVENS
for drying molds or baking big cores. No job too large.





COLEMAN
TOWER OVENS
for high speed production. Save floor space, labor and fuel.

COLEMAN CORE AND MOLD OVENS

THE FOUNDRY E
BUILDERS OF COLEMAN AN
CLEVELAND, O

to Do Your Job Right!

Coleman Ovens are the confirmed choice of leading foundries, large and small, in every class of foundry work. Perfect baking and drying, high speed operation, outstanding fuel economy, lowest maintenance cost and utmost dependability are characteristics of every Coleman Oven installation.

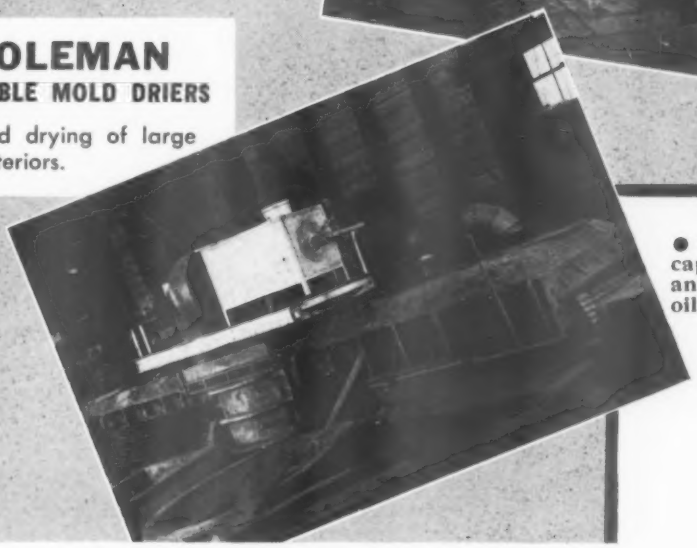
No experimenting, no second guessing, no costly delays—you can always depend on Coleman Ovens to do your job right!

Write for Folio of Coleman Oven Bulletins

COLEMAN
HORIZONTAL CORE OVENS
for large scale specialized production.

COLEMAN
CONVEYOR MOLD OVENS
for high speed continuous drying of molds.

COLEMAN
PORTABLE MOLD DRIERS
for rapid drying of large mold interiors.



● The following Coleman Oven types, in all capacities, are built for whatever fuel is most easily and economically obtainable in your district—gas, oil, coke, stoker coal, etc.

COLEMAN Portable Ovens
COLEMAN Rolling Drawer Ovens
COLEMAN Transrack Ovens
COLEMAN Car Type Ovens
COLEMAN Tower Ovens
COLEMAN Horz. Conv. Ovens
COLEMAN Portable Mold Driers

RY EQUIPMENT CO.
MAN AND SWARTWOUT OVENS
ND, OHIO, U.S.A.

COLEMAN
CORE AND MOLD OVENS

"IRONTON NOJOINT"

For Linings with LONGER LIFE

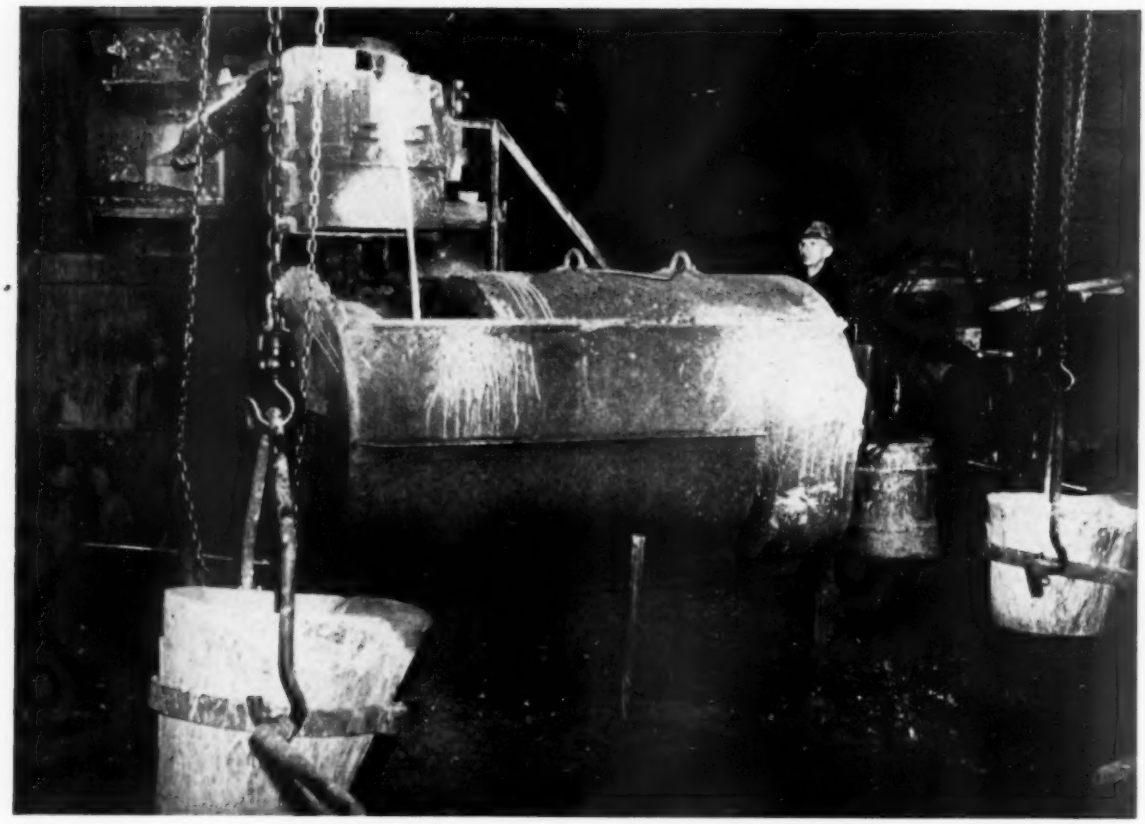


PHOTO COURTESY OF DUNKIRK RADIATOR CORPORATION

"Ironton Nojoint" plastic ramming refractory is giving unusually good service in desulphurizing and mixing ladles. It lasts much longer than regular fire brick because there are no joints in the lining for the soda ash to attack.

It is easily installed, is economical to use and gives much cleaner castings. Our service men are anxious to cooperate with you.

Ask us for our Bulletin entitled "Refractories for Desulphurizing Ladles".

Address Box 109

THE IRONTON FIRE BRICK COMPANY

RELIABLE REFRACTORIES

IRONTON OHIO

Foundry METAL CUTTING MACHINE

Keeping ahead of trends in the processing of magnesium and aluminum castings, DeWalt introduces this specially designed machine for removing gates and risers. Completely new in foundry methods, this DeWalt puts the cleaning room *on a production schedule* and increases the efficiency of the entire foundry. Write for descriptive literature.

DE WALT PRODUCTS CORPORATION
LANCASTER, PENNSYLVANIA

SECONDARY ALUMINUM
IS DOING A PRIMARY WAR JOB

Radial Aircraft Engine Parts
Tank Diesel Engine Parts
Fuses and Ammunition
Fire Control
Gun Synchronizer Parts
Aerial Radio Parts
Navigation Instruments
Aerial Cameras
Bearing Supports
Brake Housings
Brake Shoes
Cowl Rings
Drive Cases on Tanks
Transmission Cases on Tanks
Range Correction Board
Seacoast Computer
Oil Gear Unit Box, 40 mm Gun
Pistons
Booster Pump Assemblies
Upper and Lower Gun Turrets on Aircraft
Aircraft Lights and Fixtures
Gun Synchronizer Parts
Lamp Assemblies
Telescope Parts
Hand Tachometer for Measuring Speed of Propellers
Airborne Radio Gear Housing Assembly
Electric Cable Connectors

This partial list of wartime uses of secondary aluminum may suggest its adaptability to your own product

THE UGLY DUCKLING HAS BECOME A SWAN!

Let's eliminate the old idea about so-called "secondary" aluminum. Don't forget that the entire steel industry is based on the use of scrap . . . yet no one refers to steel as "primary" or "secondary." The same is true of ingot brass and bronze. The source of raw materials need not be a reflection of the quality of the finished product—particularly when all industry is observing W.P.B.'s program of scrap segregation.

Today, thanks to that careful segregation (an advance that will not be lost when the war is over) and thanks to advances in technical knowledge and metallurgical processes, the secondary smelter is producing products of superb quality.

Consulting service on aluminum and other non-ferrous alloys available through your nearest Federated office.

FMD

Federated

METALS DIVISION

AMERICAN SMELTING and REFINING COMPANY

120 BROADWAY, NEW YORK (5) N. Y.

Nation-wide service with offices in principal cities

Maintaining Best Working Conditions in Automotive Armament Foundries

The foundries where Schneible Multi-Wash Collectors are pictured above formerly produced cast parts for three cars which have long been best sellers in their respective price classes. Today these foundries have outstanding records for the production of armament castings. In such foundries contaminated air, with its detrimental effects on output, is not tolerated. The air from dust and fume creating operations is thoroughly cleaned and the collected dust and fumes readily disposed of by the Schneible Multi-Wash System.

Continuous operation is the order of the day in these foundries. From this standpoint Schneible equipment has proved of especial value for it will function efficiently with only ordinary attention 24 hours a day, year after year. Only water (other liquids where required) is used over and over again as the collecting medium. The collected dust, as sludge, is disposed of with minimum labor. Schneible Collectors are built for long, trouble-free service; with no parts to break, burn, clog or rapidly wear. In the long run, Schneible dust and fume control equipment is most economical.

Schneible Multi-Wash Dust Collectors are made in several types and sizes from 1,000 to 30,000 c.f.m. and in multiple units to control dust and fumes from an entire plant, or in single units to control a troublesome individual operation.

Submit your air contamination problem to Schneible engineers.

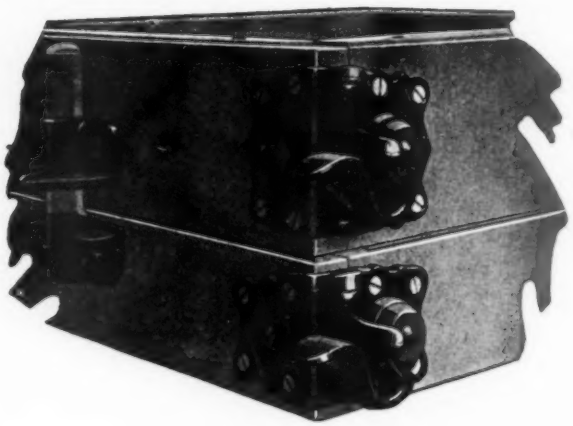
CLAUDE B. SCHNEIBLE CO., 2827 Twenty-Fifth Street, Detroit 16, Mich.

Engineering Representatives in Principal Cities

SCHNEIBLE

DUST, ODOR AND FUME CONTROL EQUIPMENT

A *Real* INVESTMENT FOR MORE PRODUCTION!



DIAMOND FLASKS

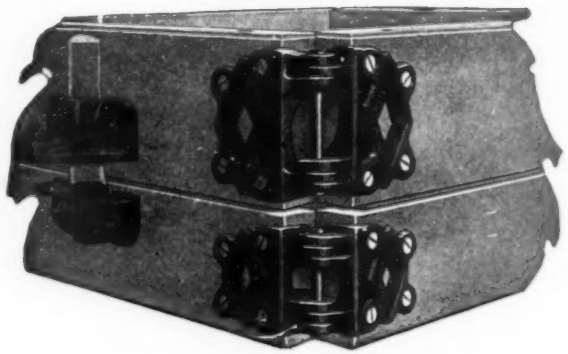
No matter what happens—you'll never be wrong if you equip for production with *good* flasks. Because we can give you many exclusive features in a flask developed over a period of 50 years, it can also be said that, "You can't go wrong on a Diamond," either. Note these important features:

■ **A SUPERIOR LATCH** (exclusive)

It's self-compensating for wear. The tighter you draw it, the firmer the grip. Has special cam which is easily adjustable as extreme wear on parts develops. Only *Diamond* has this patented feature.

■ **PRECISION-MADE**

Made from the finest grade of well-seasoned cherry stock, all flasks are made to precise measurements according to your specifications.



■ **A PATENTED HINGE** (exclusive)

Note the construction of Diamond hinges. The lugs are carefully milled and are interlocking which eliminates "play" no matter how long or how hard the flask is used.

■ **SPECIAL SHAPES**

We regularly supply customers with special shape flasks, including round flasks, and special cut partings.

STEEL JACKETS

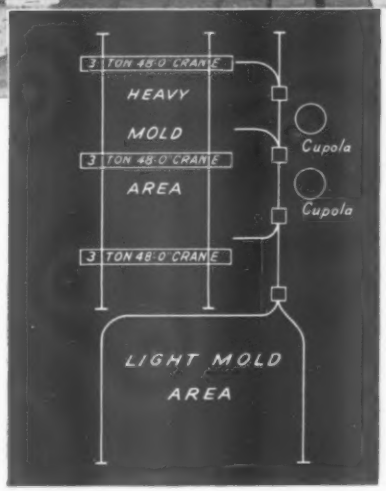
Made from Nos. 7 to 10 gauge steel, true to size and taper. Are practically indestructible, and retain their shape under severest conditions. Thousands of these jackets in use.

DIAMOND

CLAMP AND FLASK COMPANY

Telephone 2553 — **Richmond, Indiana**

Designers of* CORE PLATES, JACKETS, BANDS, FLASKS *since 1889



FOUNDRY SYSTEM SPEEDS PRODUCTION... and PAYS for itself

A careful check of all costs revealed that the entire Cleveland Tramrail materials handling system in the foundry shown above paid for itself in less than one year.

Because the equipment speeded production and improved plant efficiency, costs were lowered considerably. The savings thus effected more than paid for the sytem the first year.

The equipment is of the hand-propelled type and includes three 48-foot cranes, a 200-foot runway and other trackage, switches, hoists and carriers.

The cranes serve the heavy mold area. Hot metal is conveyed directly from cupolas to molds in this section. In the light mold area the metal is transported on the overhead rail sytem and transferred into hand pouring ladles for distribution.

Hundreds of foundries are speeding production and profiting from installations of Cleveland Tramrail.

GET THIS BOOK!
BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

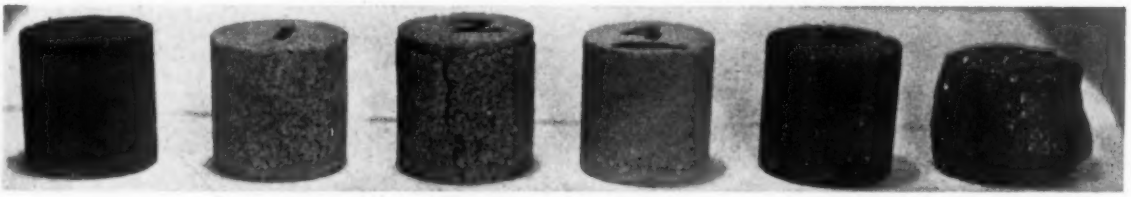
CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1155 EAST 283RD ST. WICKLIFFE, OHIO.

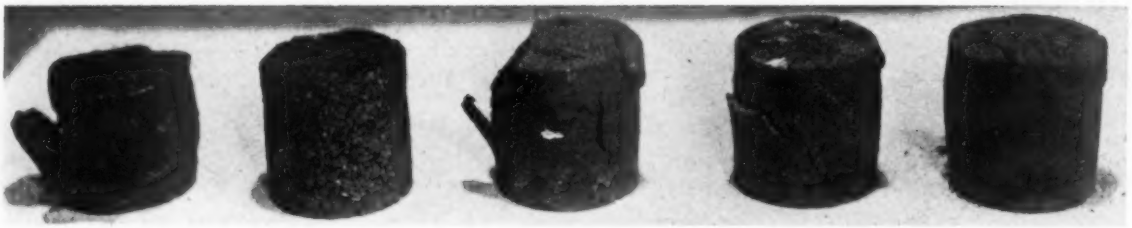
CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

Foundry Sands do not behave alike

The specimens on this page were subjected to high temperature. Originally all were the same size—2" diameter, 2" high.

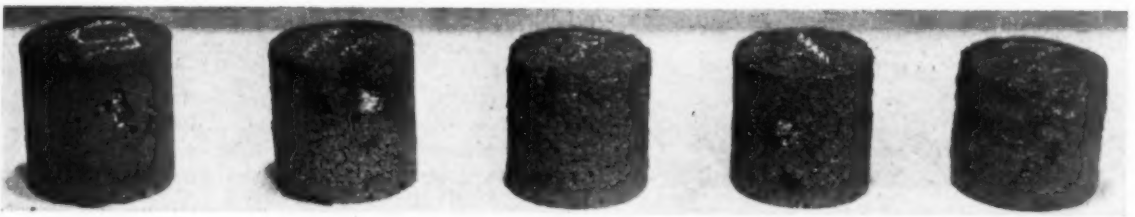
Each specimen is molding or core sand used in actual practice.





Notice the wide variety of changes from the original size and shape. Some are stable and retain their size but the majority distorted badly, including expansion, contraction, fusing, etc. This distortion is the cause of many casting defects.

The specimens below are all the same sand. They show the effect of different temperatures—2100° F. to 2500° F.



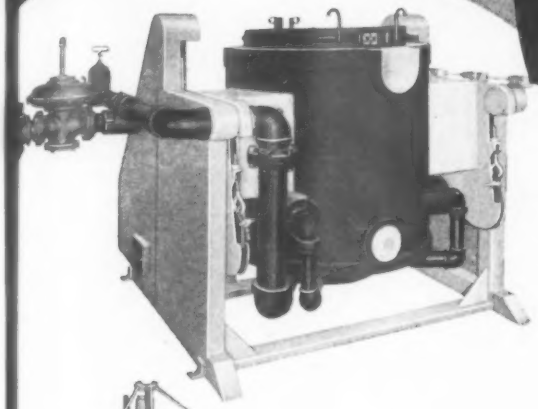
SAND BEHAVIOR CAN BE CONTROLLED:

McCormick Binders and Insulators are made to secure good sand behavior. We would like to work with you.

J. S. McCORMICK CO.
PITTSBURGH, PA.

STANDOUTS

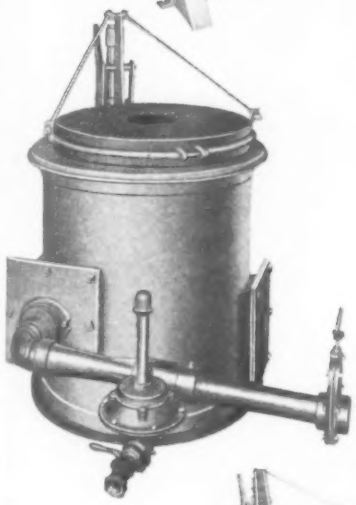
On the Production Line!



STROMAN MECHANICAL TILT CRUCIBLE MELTING FURNACES

For Brass, Bronze, Aluminum and other Non-ferrous Metals

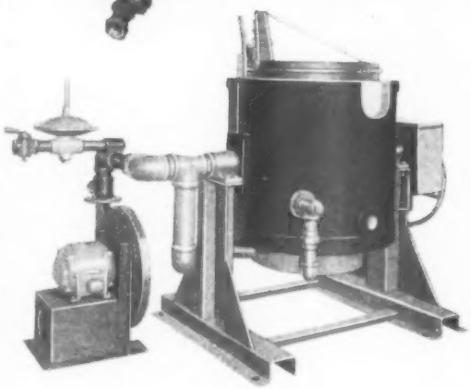
These great furnaces, mechanically tilted, include such features as the famous Stroman Stationary Lip Pour, which allows the ladle to remain in the same position during the entire pour . . . Finger-Tip Tilting Control . . . Push-Back Cover . . . Advanced Safety Features . . . Oil or Gas Fire . . . and many others. They are built in 150 to 400 crucible sizes. Send for Bulletin No. 44 for further information.



STROMAN GAS FIRED FURNACE

For Brass, Bronze and Aluminum

These furnaces are equipped with proportional mixers which automatically control the correct amount of air and gas flow to the burners. This results in the correct furnace atmosphere so necessary in the melting of Brass alloys. It also assures utmost fuel economy. This furnace may also be had with oil fire. Bulletin No. 52 explains in detail. Send for it now.



STROMAN MANUAL TILT CRUCIBLE MELTING FURNACES

For Brass, Bronze and Aluminum

These furnaces are most modern in design . . . Handle from No 40 to No. 400 Crucible . . . Can be fired by either gas or oil . . . Have Swing Type Cover . . . and their welded steel construction and correct insulation assure long life. Specifications will be sent at once upon request of Bulletin No. 52.

STROMAN IRON POT MELTING FURNACES

For Aluminum, Zinc, Lead and other White Metal Alloys

These are excellent break down or holding furnaces for use in either foundries or die casting plants. They are built to any desired size and may be fired by either gas or oil. Construction allows for ample combustion space to prevent impingement of flame on pot. These furnaces are also supplied with hoods which collect and exhaust fumes and products of combustion. Your request for Bulletin No. 63 will bring full information.

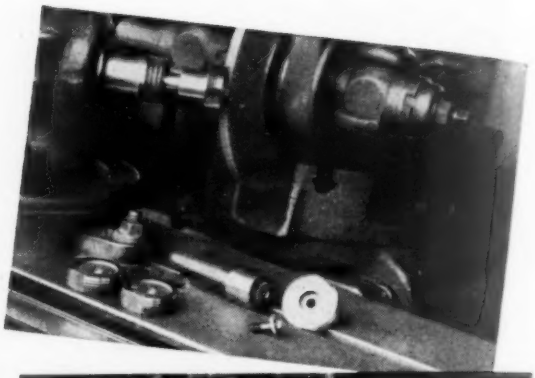
Remember - - -

Stroman makes furnaces for melting all types of non-ferrous metals . . . so bring your foundry layout and metal melting problems to them . . . their engineers are qualified authorities of long standing on these subjects and will gladly analyze your problems and offer many helpful suggestions.

STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. 300 W. ADAMS ST. CHICAGO 6

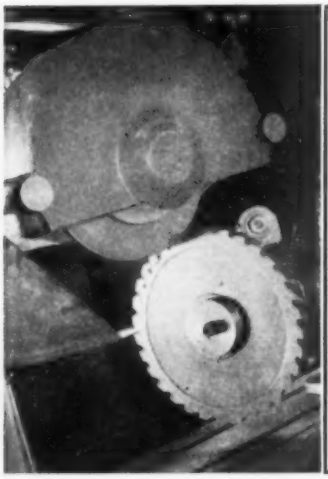


HERE'S HOW TO DO IT...

and use grinding wheels wisely, too!

TO keep war production up to quota, industry needs tools, lots of them—and lots of grinding wheels to keep them sharp. There's enough steel and abrasives to do the job—but only if every man on a grinding wheel uses the proper procedure in sharpening tools. Otherwise precious steel is wasted, and grinding wheels are used up too fast. Here are a few rules to remember that will help you "treat 'em right."

Every hour this war is shortened will save $12,000,000. The lives it will save are priceless. Let's get it over with — quickly.



Use the correct wheel for the job. It is essential that the correct grain type and size, structure and grade and the proper bond be used. The Carborundum Representative will be glad to help make your selection.

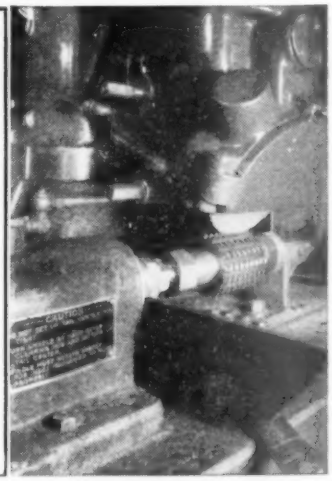
Keep grinding wheels sharp. Dress frequently with the proper dressing tool.

Sharpen tools frequently. Don't wait until they are very dull. You may waste tool steel by taking off too much stock and lose production. Sharpen them after a specific number of cuts—even if they don't seem to need it.

Control tool form. Proper tool performance can only be obtained by maintaining correct rake and clearance.

Use light grinding pressures. You may burn the tools. Edges may become soft from overheating.

Use the right equipment. Use only machines for reconditioning tools which are designed for the job.



CARBORUNDUM
REG. U. S. PAT. OFF. BRAND
ABRASIVE PRODUCTS

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.
REG. U. S. PAT. OFF.

MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

When it's machinability you want, use CHATEAUGAY Pig Iron.

This low-phosphorus, copper-free iron turns out castings that are highly and uniformly machinable—easy to turn, mill, drill or otherwise cut or grind.

It demonstrates particularly its economies in castings requiring intricate or extensive machining; such as the tire mold shown above. In finishing this casting, the blank first is machined to size on a boring mill. The tread is machined in by duplicator. And final buffing and polishing to obtain a high polish is done by hand.

CHATEAUGAY has other qualities to recommend it for foundry use, too. It provides the answer to difficult patterns of intricate design—castings with joining light and heavy sections—castings which must provide hard wearing surfaces or resistance to heat and acids.

A Republic Pig Iron Metallurgist will gladly discuss the possibilities of this iron in your foundry. Tell us when to send him.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • • CLEVELAND 1, OHIO
Berger Manufacturing Division • Culvert Division
Niles Steel Products Division • Steel and Tubes Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Bldg., New York 17, N. Y.

Republic PIG IRON

"CHATEAUGAY" Low-Phosphorus, Copper-Free
"REPUBLIC" (Northern) Foundry, Basic and Malleable
"PIONEER" (Southern) Foundry and Basic

ALSO TRUSCON FOUNDRY FLASKS • REPUBLIC CORE WIRE • FOUNDRY NAILS

WASHED DRIED AND SCREENED SILICA SAND

Carefully Selected and Graded for Foundry Use—

FOUNDRY men throughout the country know the exceptional qualities of the uniformly screened grades of silica sand produced by the Ottawa Silica Company.

The grains being almost spherical, afford greater permeability and consequently finer sand can be used, effecting better finish.

Ottawa sands are durable! They do not break up! They are ideal for sand slinger work and are without equal for all foundry purposes where synthetic sands are employed.

FLINT MOLDING AND CORE SAND SILICA

A HARD, fast-cutting, thoroughly washed, dried Sandblast Sand, screened to uniform size, is produced by the Ottawa Silica Company and sold under the trade names FLINT SHOT and DIAMOND SANDBLAST SAND. It is the most economical agent that can be employed for all kinds of exacting sandblast cleaning. The round, pearl-like grains are hard as flint. They do not split up, but wear down uniformly and can be used over again many times. This abrasive flows freely, requiring less air power and gives the castings a smooth, silvery-like, velvety finish. Ask for our booklet, "Sandblasting Up To Date".

FLINT IT PAYS TO USE SHOT

DIAMOND SAND BLAST

THE Ottawa Silica Company's three mills operate continuously the year round, making it possible to supply foundries with material promptly. Production includes a complete line of foundry sands suitable for molds, cores, furnace bottoms, sandblasting, for use generally in the steel, grey iron and non-ferrous fields—also Ground Silica (Silica Flour). The Ottawa Silica Company's engineering staff is always available for consultation and service on problems relative to the use of Ottawa Sands.

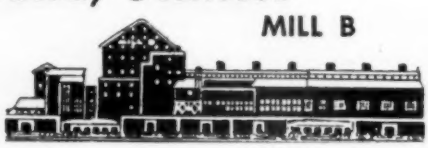
CRYSTAL 99½% PURE SILICA

OTTAWA SILICA COMPANY

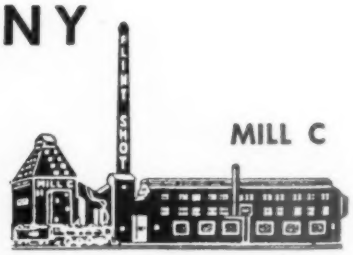
Ottawa, Illinois

MILL A

MILL B



MILL C



TREBLE THE PRODUCTION OF EVERY MAN?

★HERE'S HOW!★

Do you make small, medium, or large castings in your foundry? All are important these days as are their quantity and quality.

Herman engineers have been whipping tough molding jobs for more than forty years and have developed the "know-how" that has made the name HERMAN world-famous in foundry circles. These engineers will be glad to study your molding problems and specify the size and type Machines that will best suit your requirements.

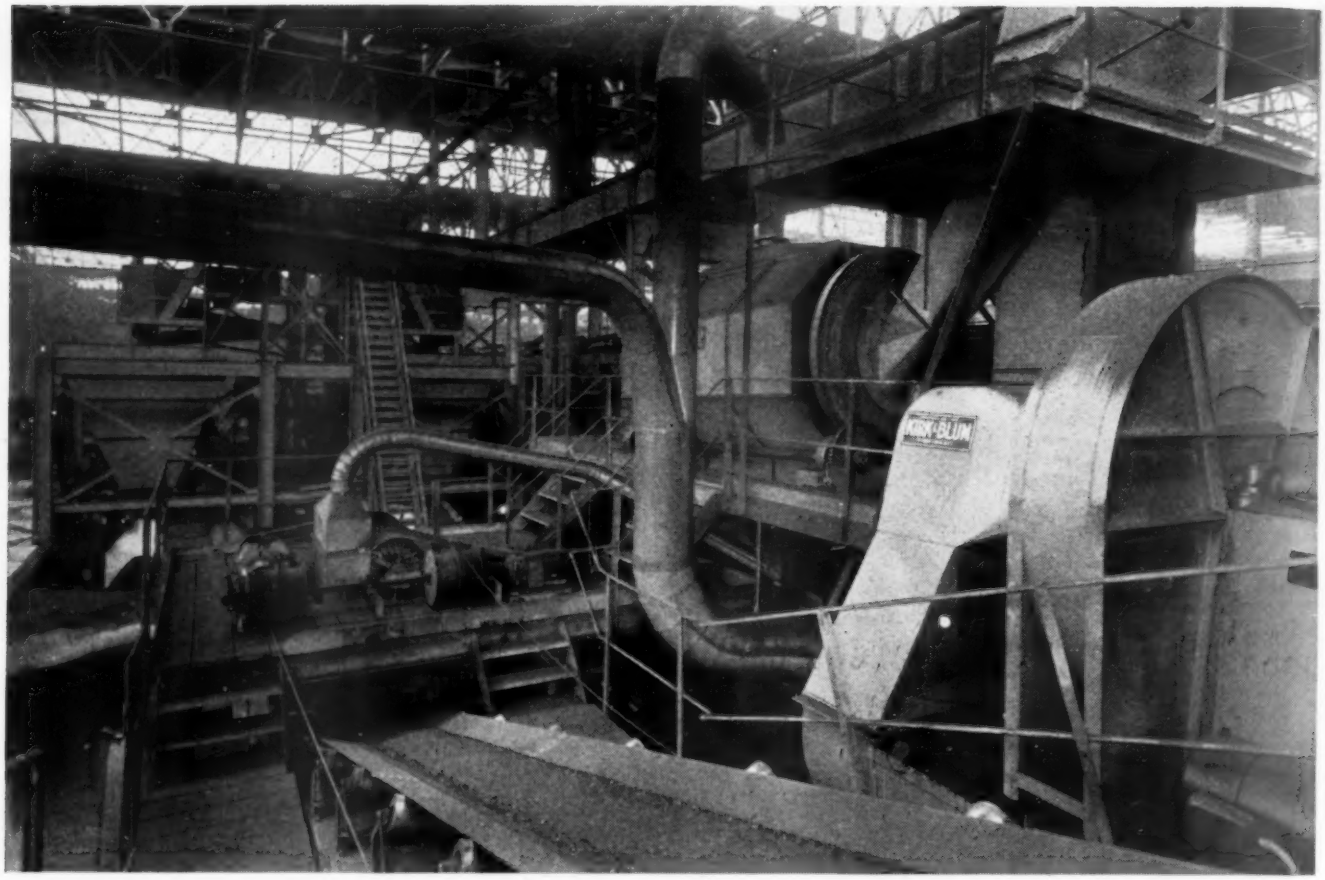
Jarring and Jarr Stripping Machines are available in any size or capacity up to 140,000 pounds. Jarr Rollover and Pattern Drawing Machines are available in a variety of sizes ranging from 750 pounds to 40,000 pounds rollover capacity in Pitless and Pit Types. Independent Rollover and Pattern Drawing Machines are also available for use with Plain Jarring Machines you may now have in operation.

Regardless of which Herman Molding Machine you choose, you are assured of highest efficiency, greatest speed, and minimum maintenance for the entire service life of every Herman. We'll be glad to discuss your problems with you.

MOLDING HERMAN MACHINES

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH, PA.

3 *TYPES of DUST COLLECTING EQUIPMENT*



USED IN KIRK AND BLUM INSTALLATION AT LARGE STEEL FOUNDRY . . .

In planning and installing this huge dust control system—Kirk & Blum Engineers specified three separate and distinct types of dust collecting equipment, in order to serve efficiently seventeen different foundry units.

A difficult problem presented itself at the outset. Owing to crane interference, all discharge pipes had to pass vertically along column centers with special transitional shapes.

To meet all individual requirements, both Roto-Clone and Cloth Filters were used. For the foundry proper, which includes all types of sand-handling equipment, Roto-Clones were utilized, while dust arrestors were installed in the cleaning buildings.

In the pattern shop, a centrifugal-type collector and storage bin was installed for shavings and dust collection.

This installation is typical of the *specialized* service rendered by Kirk & Blum Engineers. All Kirk & Blum Dust Control Systems are designed and installed to meet *individual requirements,* assuring top efficiency and economical operation.

The **KIRK & BLUM** *Manufacturing Co.*

AN ORGANIZATION OF ENGINEERS AND MECHANICS

2808 SPRING GROVE AVE. **CINCINNATI, OHIO**

Send for Booklets

- **"DUST COLLECTING SYSTEMS IN METAL INDUSTRIES"**
- **"BLOWER SYSTEMS FOR WOODWORKING PLANTS"**
- **"FAN SYSTEMS FOR VARIOUS INDUSTRIES"**
- **"INDUSTRIAL OVENS"**
- **"COOLING SYSTEMS FOR THE GLASS INDUSTRY"**
- **"DATA ON KIRK & BLUM PRODUCTION FACILITIES"**

BACK OF THE NAME MELTRITE

NINE YEARS AGO we introduced to the trade a new type of pig iron—MELTRITE.

Instead of from 75 to 100 pounds or more, these pigs weighed only about 40 pounds each—an important departure from practices of former years. They offered improved melting qualities and effected important savings for pig iron users.

Since then the smaller pig has been universally adopted by pig iron producers. And MELTRITE has proved to be all that the name implies. *Today it is the most widely used merchant pig iron. Back of the name are pioneering, progress, performance throughout our 61 years of service to industry.*

PICKANDS MATHER & COMPANY

CLEVELAND · CHICAGO · DETROIT · ST. LOUIS · ERIE · DULUTH · MINNEAPOLIS · TOLEDO

New York City—William R. Alley · Philadelphia, Pa.—Carson, Marshall & Co.

San Francisco and Los Angeles, California; Seattle and Tacoma, Washington—H. L. E. Meyer Jr., & Co.

P M

IRON ORE ☆ PIG IRON ☆ COAL ☆ COKE

TAM ZIRCONITE PRODUCTS AVAILABLE

TAM
Foundry Zirconite Sand (in three grades)
Melting Points from 3650° F to 3950° F

TAM
Foundry Zirconite Flour (in two grades)
Melting Points from 3650° F to 3812° F

TAM
Foundry Zirconite Mold and Core Washes (in three grades)
Super-refractory compounds with melting points from 3600° F to 3775° F

GENERAL OFFICES AND WORKS: NIAGARA FALLS, N. Y., U. S. A.
EXECUTIVE OFFICES: 111 BROADWAY, NEW YORK CITY

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Thor CHIPPING HAMMERS

HERE'S PERFECT

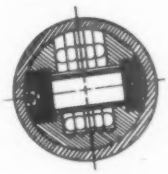
Power Control

The Thor self-seating throttle valve is actuated so that the hammer is under perfect control for both power and return strokes. Staggered inlet holes in the bushing provide finely graduated control from an easy-starting, light blow through to full speed and power.

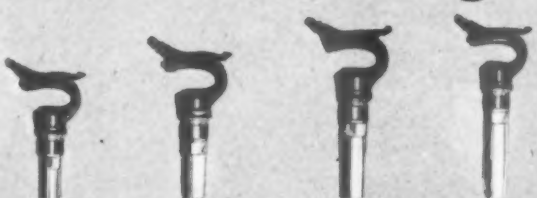
Independent Power

FOR SPEED AND SMOOTH OPERATION

Thor design provides two sets of air inlet holes in the one-piece valve block. One set admits air for the power stroke and a different set admits air for the return stroke; accurate determination of the size, number and location of these holes gives Thor hammers the speed, power and smoothness for which they are famous.



Look At The Range!



Thor Chipping Hammers are made in a complete range of sizes . . . with strokes from ¾" to 8" . . . and in Rocker valve, Spool valve, Plate valve and Sleeve valve types. A hammer for every job with Open or Closed Style handles. For complete information and specifications write for Catalog No. 528.

• EVERYTHING you want in speed and power for fast removal of metal you'll find in *Thor* Chipping Hammers . . . *plus* the ability to take a wide range of cuts with the same tool. With Thor's perfect throttle control the hammer can be started slowly with a light blow, then *gradually* and *smoothly* stepped up to maximum speed and power. You get smooth, even chips with less effort by the operator.

Positive cylinder valve action, with the air for the power stroke and the air for the return stroke supplied through different ports, assures the ideal combination of speed, power and smoothness. Perfect balance between this speed and power and the weight distribution reduces vibration to a minimum.

Thor *Portable Pneumatic and Electric Tools*

INDEPENDENT PNEUMATIC TOOL COMPANY

600 W. JACKSON BOULEVARD, CHICAGO 6, ILL.

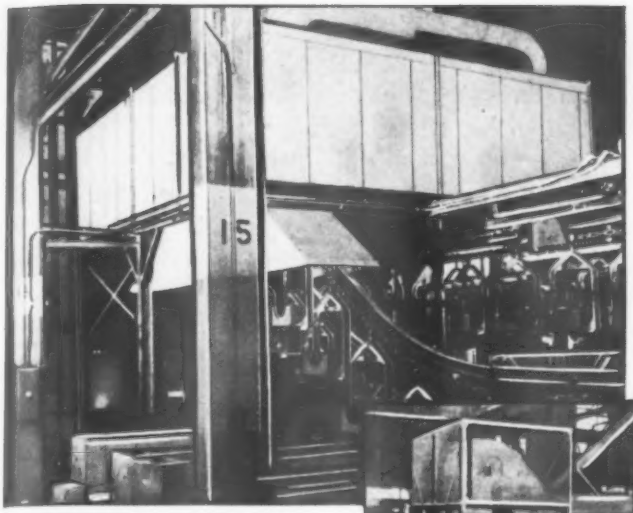
Branches in Principal Cities

FANNER CHAPLETS

Whatever your CHAPLET requirements may be,
there is a FANNER CHAPLET to fit the job.

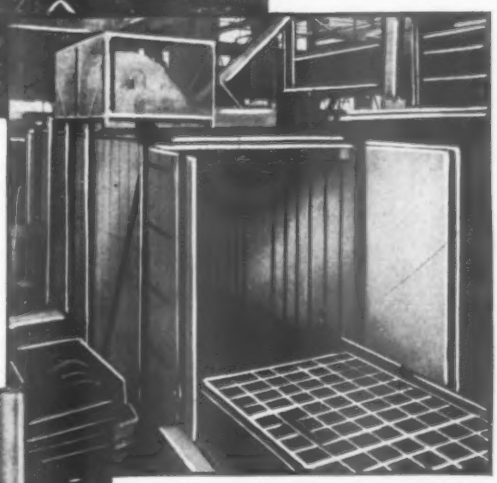
THE FANNER MANUFACTURING COMPANY, CLEVELAND, O.

THE CANADIAN FANNER LTD., HAMILTON, ONTARIO, CANADA



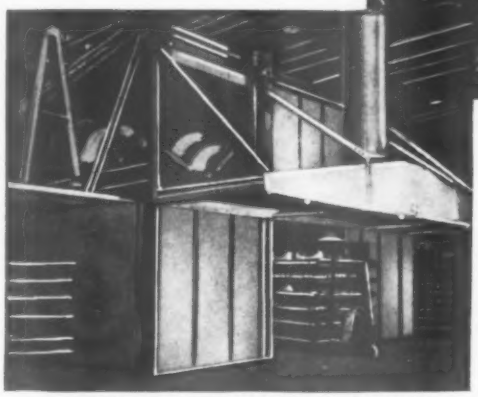
CONTINUOUS CORE SPRAY DRYING OVEN

Racks loaded with sprayed cores on four pass monorail conveyor travelling continuously through 50 ft. x 17 ft. elevated oven, heated by convection from an external gas fired air heater.



DRYING 50 TONS OF MOLDS PER CAR LOAD

Recirculating type oven for uniform heating despite dead weight load of car and flasks of 100 tons; supplied with integral convection gas heating, interlocking air, fuel and ventilation controls for maximum production, operating safety and minimum fuel consumption.



8000 LBS. OF CORES PER OVEN

Assorted sizes and shapes on two racks per each of 3 ovens baked at 450°F. Each oven supplied with individual heating, recirculating and exhaust systems for complete, safe, uniform baking in minimum time

GEHNRICH

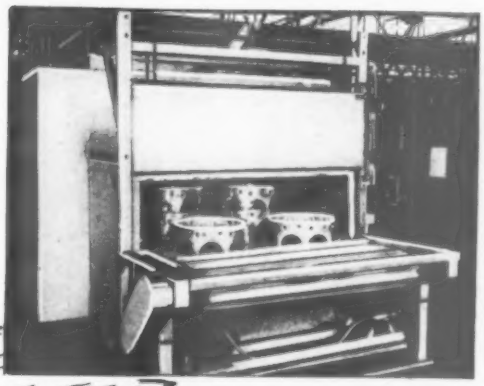
CONVECTION TYPE

FOUNDRY OVENS

PRODUCE

Better Cores and Castings Save Heat and Fuel Save Time and Labor

The success of Gehnrich Oven installations is based on the design and construction features built into each job to meet the specifications set up for heating quality, production rate, fuel economy and handling method. Gehnrich versatility in meeting the heat processing needs of the foundry industry has paid dividends to the hundreds of satisfied users. This has become particularly apparent under the exigency of war-time production and will be followed by the peacetime demand for even better oven performance.



HEAT TREATING ALUMINUM CASTINGS

In a push button, cycle controlled intermittent flat conveyor electric oven for aging and heat treating airplane engine crankcases within very close temperature limits.

Write for This Foundry Book

LEARN WHY LEADING FOUNDRIES INSTALL GEHNRICH OVENS FOR PERFORMANCE QUALITY

GEHNRICH OVEN DIVISION

W. S. ROCKWELL COMPANY

Batch Type and Conveyor Ovens • Oil - Gas - Electric - Steam - Coke

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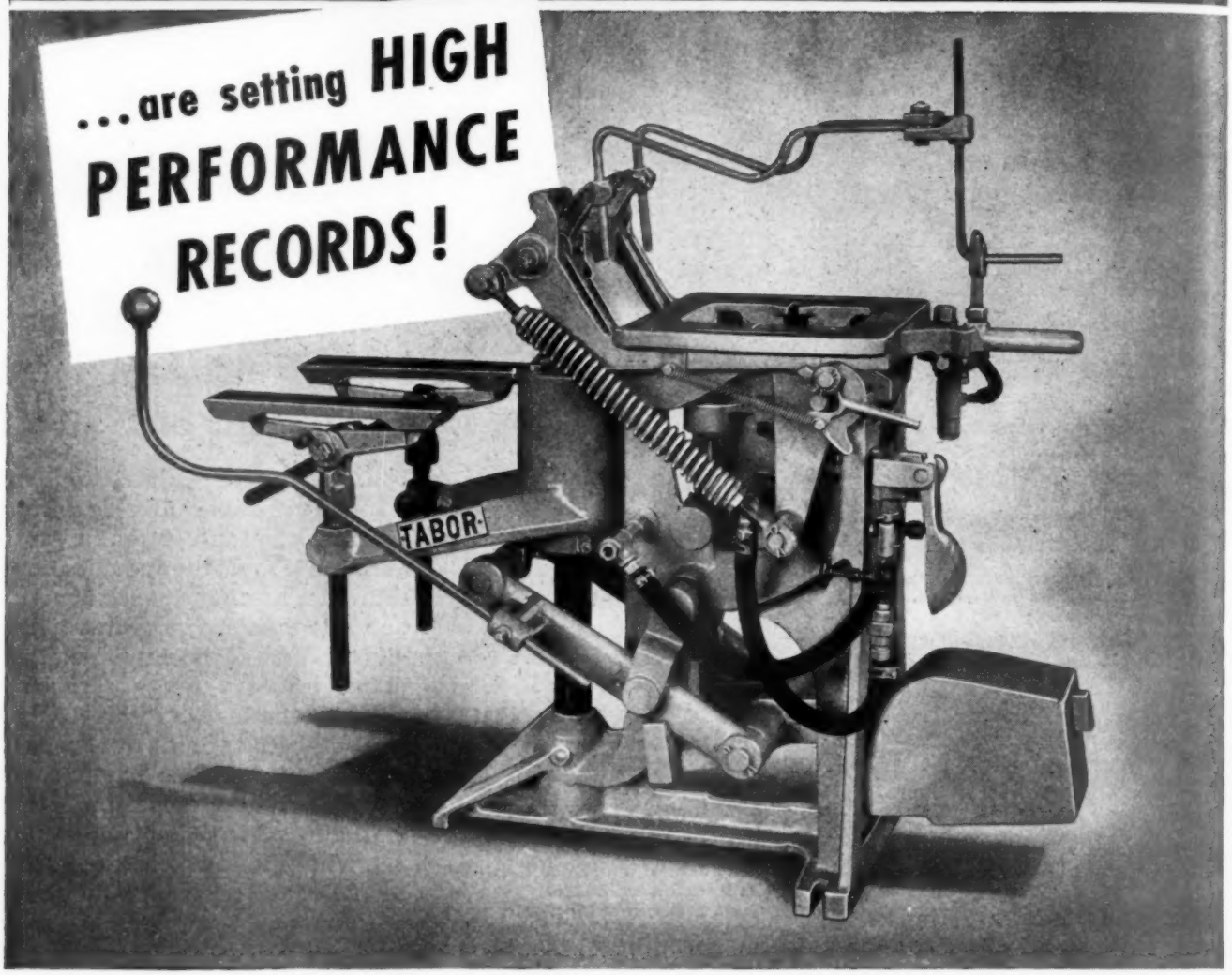

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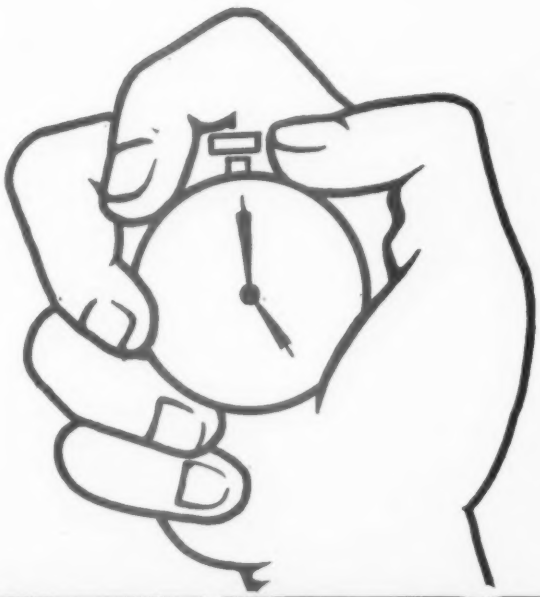

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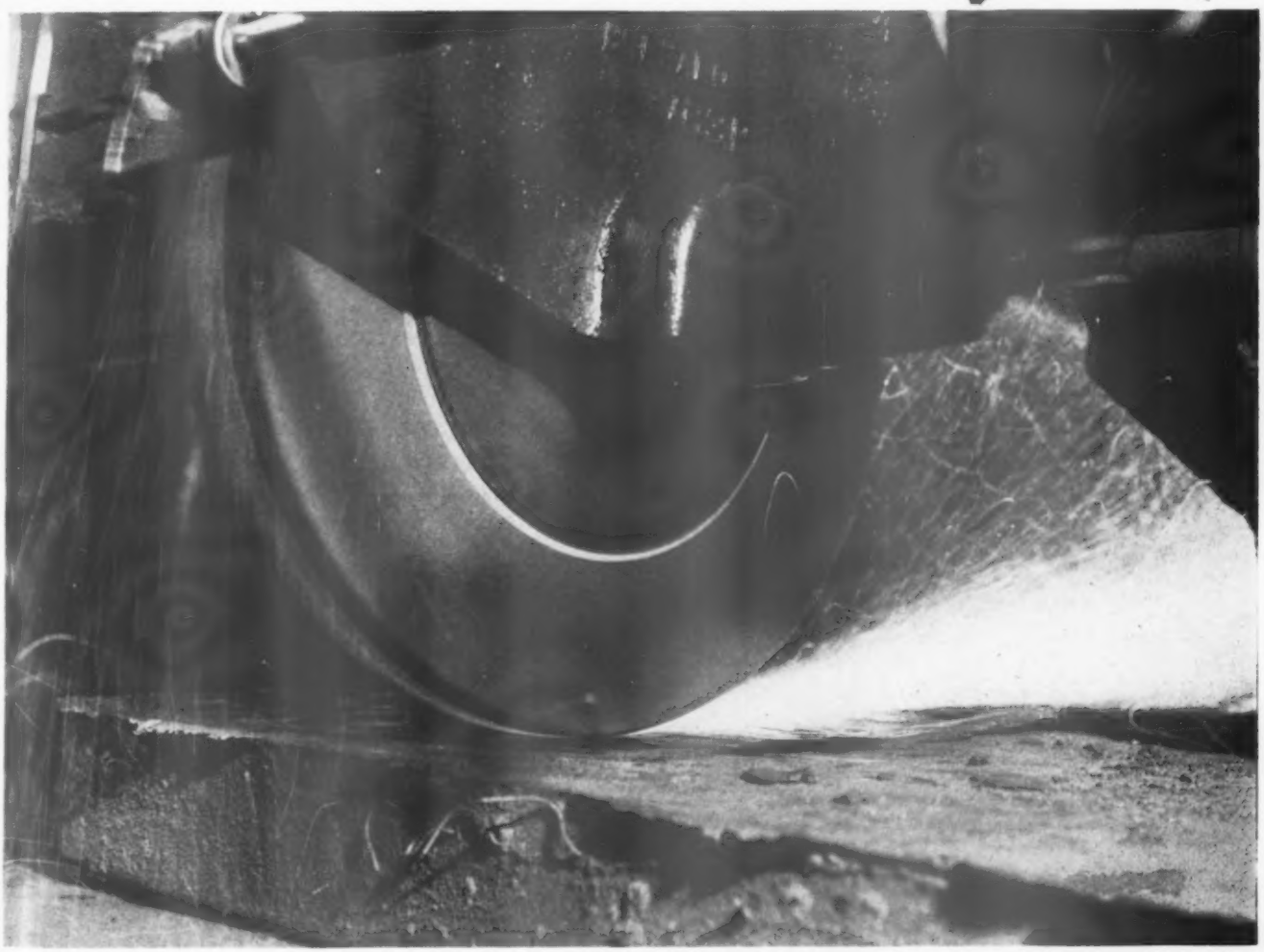

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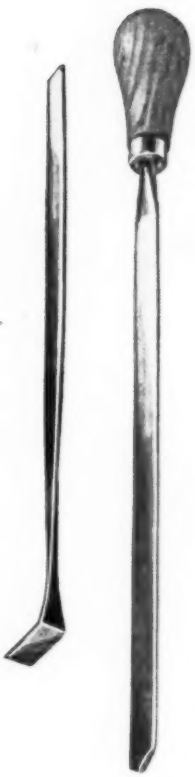

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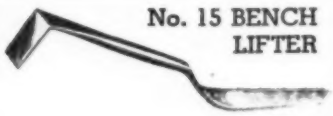

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Government Should Provide Realistic Approach To Foundry Manpower Problems

MANPOWER continues the most pressing problem of the foundry industry, and the one factor preventing production of castings in sufficient quantities to meet vital war needs. Whether the problem results from real shortages of men and women in sufficient numbers to operate existing facilities at full capacity; a general slowdown of operations due to the unwillingness of workers to perform in a manner comparable with prewar efforts; inept handling of the foundry labor problem on the part of national War Labor Board and the various regional boards; failure of government agencies to divert available labor to the foundry industry; inability of industry to provide satisfactory working conditions; or a combination of these and other factors, the result is becoming detrimental to the war effort and the foundry industry.

Since the beginning of the present great emergency, no industry has done more in the service of the nation at war. Because castings are basic in the construction of most of the weapons of war, just as they were employed in the production of most of the machines of peace, foundries have been called upon to produce in greater quantities than ever before. Available statistics indicate that a tremendous production job has been done, but the story of the most important developments in practice and product generally must remain untold until the end of the war. In spite of this excellent record, and regardless of the fact that the industry has the facilities and experience to produce all of the castings needed for the war effort and at the same time satisfy many essential civilian requirements, if only given some assistance in the matter of labor, the manpower problem of the foundry industry seems to have become the No. 1 patient for the fumbling doctors of an ever-growing bureaucracy. Everyone is having a field day in writing prescriptions, but there appears to be no consultation of the experts. And in the meantime, news stories hint that the all-important landing craft program and possibly the army truck program may be delayed because of inability of foundries to supply essential castings. Press and radio tell of strikes of foundry workers in the Pacific Northwest, Chicago and other centers of the country which result in further delays in the production of castings.

The most recent bit of experting is credited by the War Production Board to the Special Foundry and Forge Shop Labor Advisory Committee, which consists of 14 representatives of the American Federation of Labor and Congress of Industrial Organizations in the foundry and forge shop industries. A recent news release of WPB states in part:

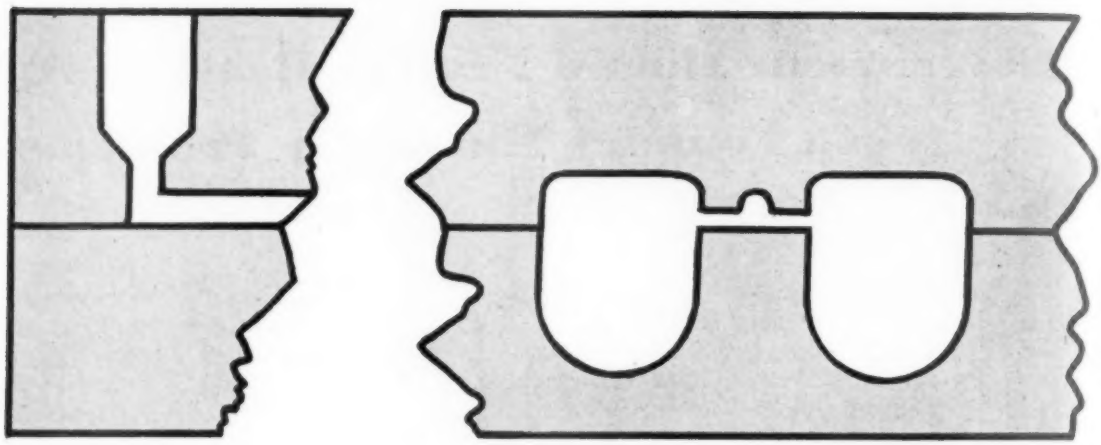
"The advisory committee recently discussed, with representatives of the Division of Labor Standards, the U. S. Public Health Service, and the WPB production specialists, the health and safety conditions prevailing in foundries and forge shops. The committee decided to request the Division of Labor Standards to intensify inspection procedures throughout the country in order to obtain more thoroughgoing compliance with the requirements of the Walsh-Healy Act and the various safety codes for foundries and forge shops. The Walsh-Healy Act requires that all concerns undertaking government work must provide safe working conditions for their employes.

"The advisory committee has also outlined the manpower difficulties that the foundries face, due in part to the inherently unattractive nature of foundry operations. The committee contended that new workers refuse to enter the industry at present wage scales, and therefore recommended to the War Labor Board that a reconsideration be made of the present area wage brackets established for the foundry industry."

No, the foundry industry does not need more government checkers, more bureaucrats to "intensify inspection procedures". The efforts of an army of such investigators would not increase the production of castings perceptibly, unless these government employes were put to work making molds or unloading pig iron in the foundry yard. What the industry does need in order to make more castings for war is greater understanding and co-operation on the part of governmental regulatory bodies. There is nothing so wrong with working conditions in the foundry industry or the manpower situation that the problems cannot be cured if the natural laws of supply and demand are allowed to operate.

The problems of castings production can be helped greatly if the government will stop the hoarding of labor on the part of some war plants; give foundries permission to pay wages high enough to compete for the available labor supply; increase the ceiling prices on castings to compensate for these additional costs, and provide draft deferment for essential workers.

Frank G. Steinebach
Editor



Casting in Plaster Molds

PLASTER of paris mixtures have been used for hundreds of years as a molding medium for casting nonferrous metals. One of the early methods developed for casting metal in plaster molds is the lost wax process. The pattern is made of wax that will melt at a fairly low temperature. A plaster mixture is poured around the pattern and allowed to set. It then is baked thoroughly during which time the wax melts and runs out, leaving the plaster mold ready to receive the molten metal. In the past this process generally was confined to casting statuary. A special process has been developed for casting bronze medals and another for jewelry.

During recent years the use of plaster molds for general foundry casting has increased considerably, due to advantages for certain kinds of castings and to the development of metal casting plaster designed to meet the needs of the foundry industry. The general foundry process to be described is adaptable to foundries of any size. Suggestions given apply largely to castings made in small flasks around 12 x 16 inches, and some changes will be necessary in making larger castings.

There are several advantages in using plaster molds. Castings are smoother than sand castings and require less machining. In fact, in many castings machining is eliminated entirely, thus resulting in the use of less metal. Due to slower cooling of the metal, better grain growth results and better physical properties are achieved in copper and magnesium alloys. As the plaster molds and cores are soft they do not prevent shrinkage of the metal on cooling. Any restriction of this natural shrinkage sets up strains or fine cracks in the casting.

It is not necessary that mold makers have previous experience in making plaster molds. Gates and risers are in the pattern and anyone with reasonable intelligence can make good plaster molds after two or three days training. In the case of magnesium alloys no special preparation of the mold is necessary, nor are inhibitors included in preparing the mold. Before casting, a small amount of sulphur dioxide is introduced in the sprue to purge the air from the mold, as is done with sand molds, but no sulphur, boric acid or other inhibitor is included in the mold.

Brass Patterns Are the Best

In the production of castings in plaster, the finished casting will be no better than the original pattern so far as surface and dimensions are concerned. For that reason it is necessary special care be taken in preparing the pattern and that the proper material be used. For long runs brass makes the best pattern. For shorter runs white metal or pattern metal may be used or even type metal, since plaster is not as abrasive as sand. When wood patterns are used for a very few castings they should be coated with a synthetic resin type varnish. This generally is sold as a bar and table top varnish. Since the pattern is going to be covered with a warm wet mixture for anywhere from 15 to 30 minutes every time it is used, it is absolutely essential that wood patterns be thoroughly waterproof. A type of plaster of paris known as pattern plaster may be used for making patterns if only a few molds are needed. Aluminum is not used for patterns in this process. Aluminum is porous enough that it is

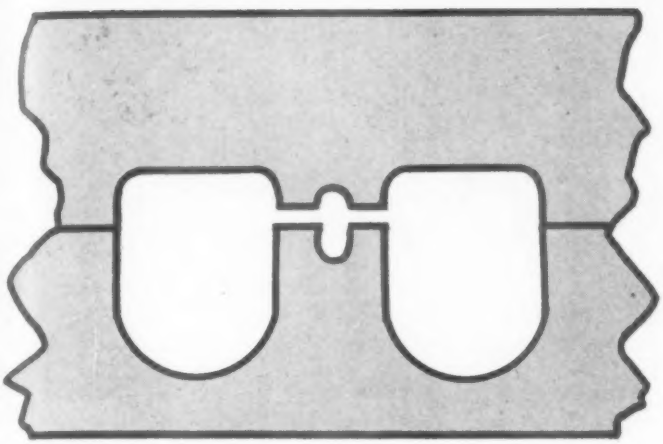


Fig. 1 (Far left)—Best results are obtained by choking the sprue to a considerable degree as indicated in this rough sketch

Fig. 2 (Center)—For brass, bronze and aluminum alloys placing the runner in the cope will produce satisfactory results in castings production

Fig. 3 (Left)—Placing half of the runner in the cope and the other half in the drag appears to give the best results with magnesium alloys. The runner always should have a larger cross sectional area than that of the choke in the sprue

difficult to obtain a good parting, and the results are rarely satisfactory. Surface of the pattern should be brought to a high polish. Wood patterns which have the grain showing on the surface will produce castings with similar imperfections.

Where patterns are mounted on a plate it is best to use a cope and drag plate instead of a matchplate. By using cope and drag plates both the cope and the drag can be made at the same time, which doubles the production of the single casting. Any metal plate can be used that is smooth. Steel, brass, aluminum or magnesium alloy plates are satisfactory. At least two locator pins should be set in the plates, and these pins should be at least ½-inch in diameter and 1½ inches high. At the same time joining pins should be made of the same diameter. Length of these joining pins will be equal to the length of the locator pin in the cope plate plus the length of the locator pin in the drag plate. These pins are used for joining the cope and the drag plaster molds. All of these pins should be tapered the same. A hole should be drilled in the pattern plate to accommodate the sprue pattern.

The sprue pattern should be machined or cast, an inch or two longer than the cope is thick. Best results are obtained by choking the sprue as indicated in Fig. 1. The end of this pattern that fits into the plate should be from 5/16 to ½-inch in diameter, depending on the size of the flask and the metal to be cast. For a flask 12 x 16 inches a diameter of 5/16-inch is large enough for brass but should be ½-inch for aluminum. This diameter should be carried up ½-inch above the spot where the sprue joins the runner, then funnel out to the full diameter needed for pouring. A 1¼-inch diameter sprue should be sufficient as the metal must be poured slowly. Before pouring the plaster this sprue pattern is inserted in the hole in the pattern plate, covered with parting, and is removed after the plaster has set.

Runners should be larger than the choke in the sprue. For brass, bronze and aluminum, the runners can be entirely in the cope as shown in Fig. 2 but for magnesium alloys the runners should be carried in both the cope and the drag and the gate taken off near the center of the runner. Since some of the impurities in the magnesium alloys are light and others heavy, the purest metal will be near the center line of the runner and this method of gating will insure purer alloys in the casting. This method is shown in Fig. 3.

Gates Smaller Than in Sand Molds

Gates should be much smaller than those provided for sand molds since the plaster molds have a high insulating value and there is little danger of small gate freezing prematurely. Only blind risers or shrink bobs should be used, but these must be of ample size and properly placed to feed the casting. The casting should be gated through the shrink bob. The same rules that apply to feeding heavy sections and to obtaining directional solidification in sand casting apply equally in plaster casting. Since solidification takes place more slowly in plaster, proper feeding is of utmost importance.

Use of snap flask that fits tight against the plate is recommended. Sides of the flask should be perpendicular but not (*Please turn to page* 183)

By Fred Chambers

District Manager
National Gypsum Co., Luckey, O.

Molds Laundry Machinery Castings

By Pat Dwyer

PHENOMENAL growth and development of the laundry machinery industry in the comparatively short period since the turn of the century is exemplified in the long racks of patterns extending from end to end and from floor to ceiling in the pattern storage building of the American Laundry Machinery Co., Rochester, N. Y. Approximate number of individual patterns is in the vicinity of 50,000. A number of these patterns are for machines no longer in production, machines that have been superseded by newer and improved models. The patterns are held for the benefit of customers who occasionally need spare parts to replace parts broken or worn out in service.

Formerly the large wood patterns were molded singly by hand in wood flasks. Under a new regime inaugurated several years ago all the wood flasks were thrown out and replaced by a complete outfit of cast iron flasks in standard sizes and with all the units in each size interchangeable. Occasional old-time patterns still are molded singly by hand, but nearly all patterns in the shop are mounted on plates or boards for use on several types of molding machines ranging in size from the comparatively small squeezer machines on the snap flask floors, to large jolt ram, rollover machines capable of handling flasks up to 12 feet in length in the main bay of the foundry.

Top and bottom flanges on the drags and bottom flanges on the copes are machined to rest accurately on the pattern boards or plates, and also to facilitate the stacking of two or more drags on top of each other when extra height is required for certain castings. Other features on these flasks worthy of mention include a split or expansion joint at one corner and wedge pads on the flange for self tightening clamps. The joint shown at A in Fig. 4 is held together with bolts. The clamp is shown at B and the wedge pads on the flange at C. The joint permits expansion and contraction of the flasks while heating or cooling. When the mold is closed the clamps are placed in position and tightened with a blow from a hammer. After the casting is poured the clamps are released just as readily, thus eliminating the use of wood or metal wedges which need constant replacement through the peculiar perversity of inanimate objects in getting lost or buried in the sand when Tony and Joe and other husky members of the night gang swing the big hammers while shaking out the castings. The cast iron clamps are too large and heavy to be lost in this manner.

The foundry building 125 x 300 feet, amply lighted and ventilated and with an exceptionally high roof, is divided into three longitudinal bays by two rows of steel columns which support the roof and also support runways for two cranes in the side bay and three cranes in the center or main bay. The ventilating system differs to a considerable extent from that usually found in foundry buildings. Fresh air drawn in by fans is driven downward through

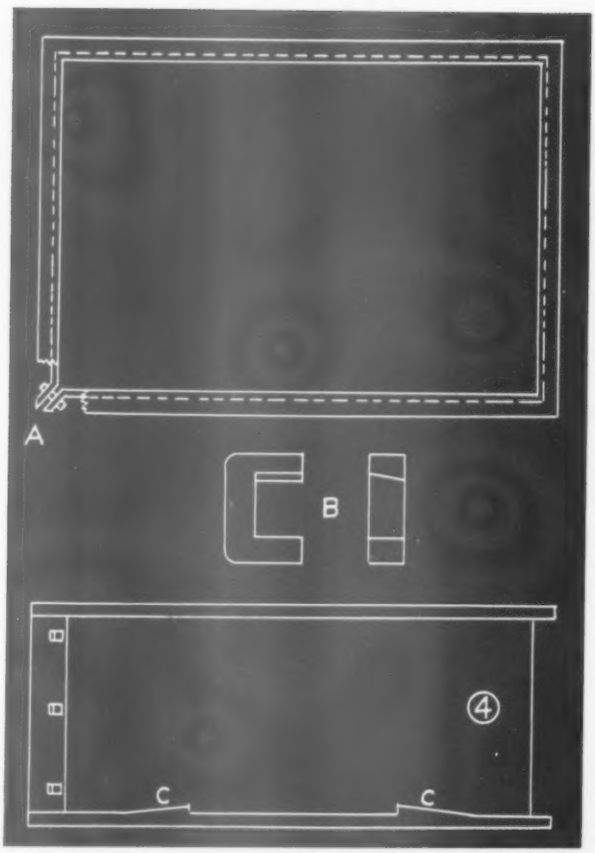


Fig. 1—Chamber cores in wide variety of shape and size are surrounded entirely by metal except for two small pipe connection openings at each end. Fig. 2—Diesel piston cores are provided with gate openings. Fig. 3—Showing gates on drag print. Fig. 4—Flasks are split and bolted at one corner to permit expansion and contraction. Clamps are tightened automatically on wedge pads on flask flange

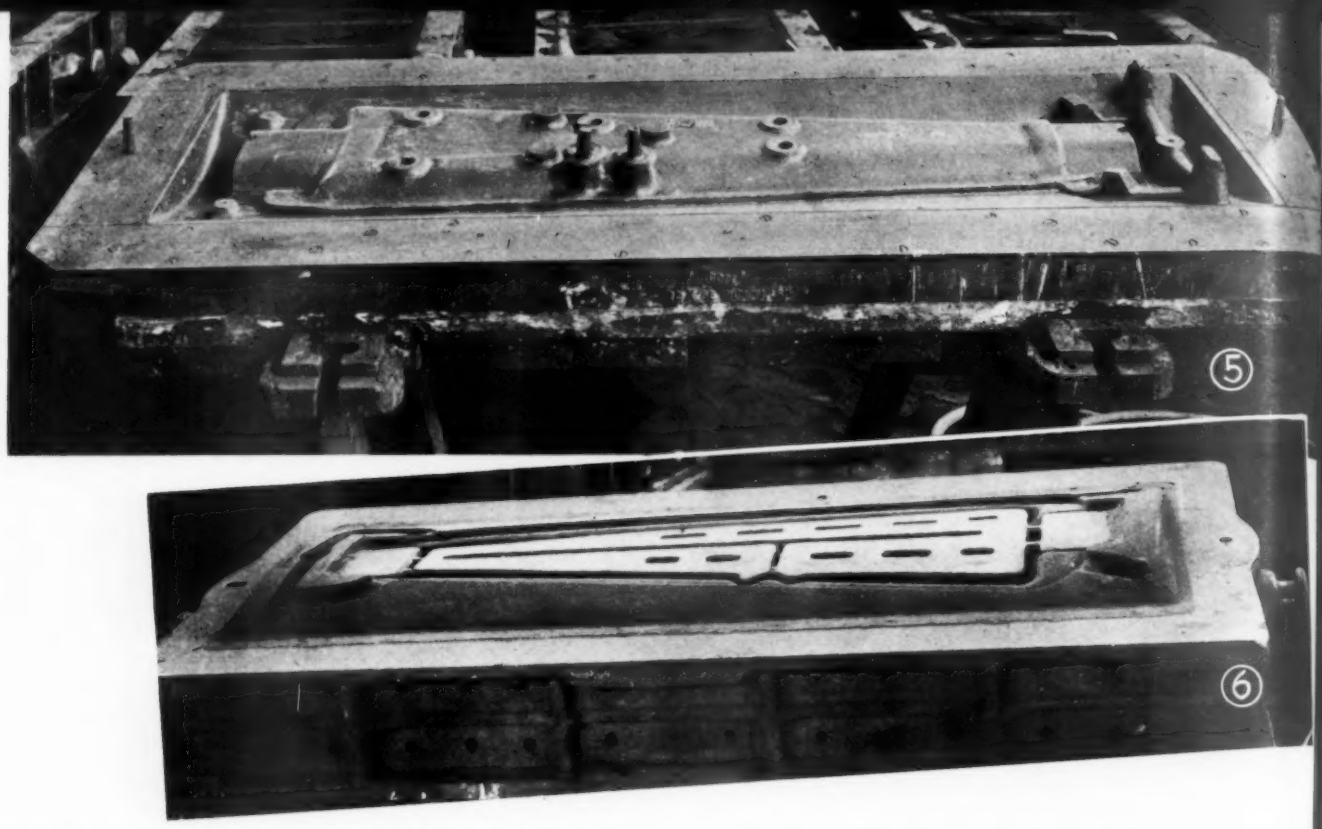


Fig. 5—Gates, runner and feeders shown at right are attached permanently near one end of the cope pattern plate. Figures on the side (center) show flask size. Fig. 6—Core is supported by block prints at each end. Casting is poured at one end through gates at top and bottom. Fig. 7—Dry sand cores form the side and end walls. Fig. 8—Jacket cores for diesel engine cylinders are made and dried in halves and afterward assembled. Construction involves skillful arrangement of reinforcing rods and vent openings. Fig. 9—Typical mold and core showing gating arrangement and vents. Fig. 10—Drag mold for diesel engine cylinder showing method of gating. Fig. 11—Floor of diesel engine cylinder molds with cores in place

a number of large tubes extending vertically from the peak of the roof and spaced on 30-foot centers. This air current unites with the ascending steam, heated air and dust, reduces the combination to an innocuous mixture that flows through open sections of the windows high up in the side walls of the building. Exceptionally clean conditions prevailing inside and outside the foundry seem to indicate that the method is effective.

Iron in use in this foundry conforms to details of the meehanite process. The same care and precision essential to the production of metal to meet high and definite specifications are observed not only in molding, coremaking, pouring and cleaning, but also in the neat and orderly manner in which all work is conducted. Gangways are kept open. Empty flasks sufficient for the day's operation are stacked where needed on the various floors in the vicinity of the molding machines. Flasks not in active use are stacked in the yard which is spanned by an overhead electric traveling crane. Molds ready for casting are set up in straight rows across the central space in the main bay of the foundry and with practically mathematical exactitude in relation to the gangway. Common enough in a production type foundry where molds are uniform in size, the arrangement is worthy of comment in a foundry producing castings in wide variety of size and weight.

Spent or burned molding or core sand is dumped through gratings between the rails of an industrial track which extends from one end of the shop to the other end and which also serves as a main gangway. Tops of the rails are flush with the cement floor, and hatch covers conceal the gratings when they are not in use. A conveyor belt under the floor carries the waste material to the boot of a bucket elevator which discharges into a large circular tank mounted on suitable high supports outside the building. At convenient intervals a truck is backed under the tank and loaded with the waste material through a nozzle controlled by a gate at the bottom of the tank. Since the plant is bounded by a railroad on one side and by a residential neighborhood on the other three sides, the final disposal of waste material is more of a problem than where a foundry has a convenient gully in the back yard. In this instance the spent sand, slag from the cupola and other miscellaneous foundry rubbish are disposed of on the outskirts, where such material can be used for filling in.

Small and medium weight castings are made in the north bay of the foundry in green sand molds. Heavy castings are made in the center or main bay in green sand molds in the east section and in dry sand molds in the west section. After the molds made in the second section have been dried in the battery of ovens, they are assembled for pouring in the center sections.

The third or south bay of the foundry is devoted to several activities and purposes. Green sand facing is prepared in a muller type mixer and distributed from a station in the vicinity of the green sand floors. Two cupolas with auxiliary equipment, blowers, charging floors, ladle preparation plant, operation and repair materials, occupy most of the central space in this bay. The smaller cupola is maintained as a spare and for use during occasional slack periods. For the past few (*Please turn to page* 162)

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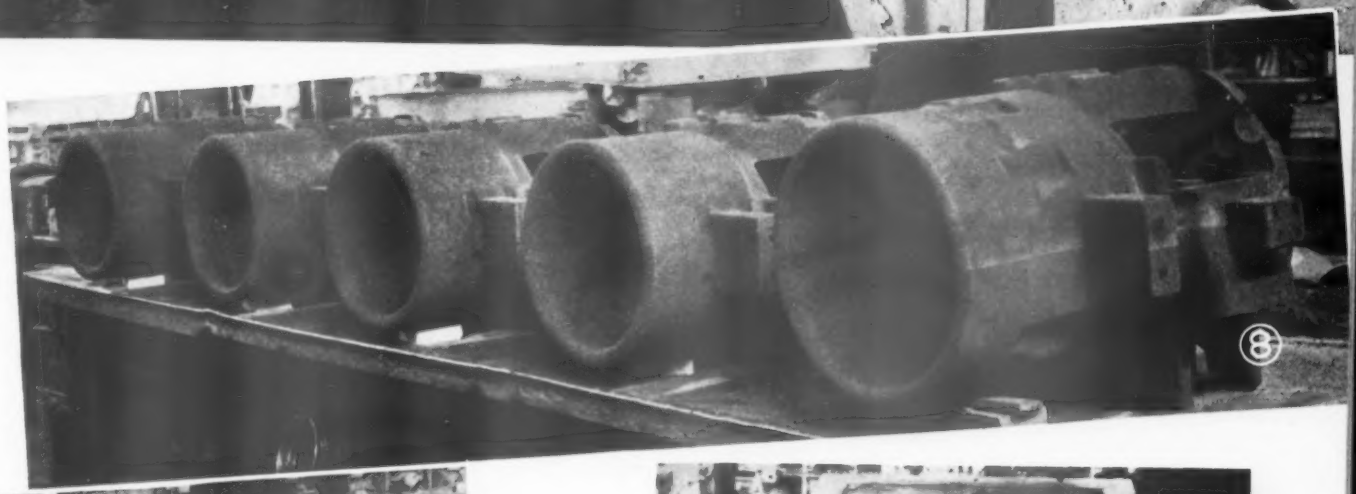

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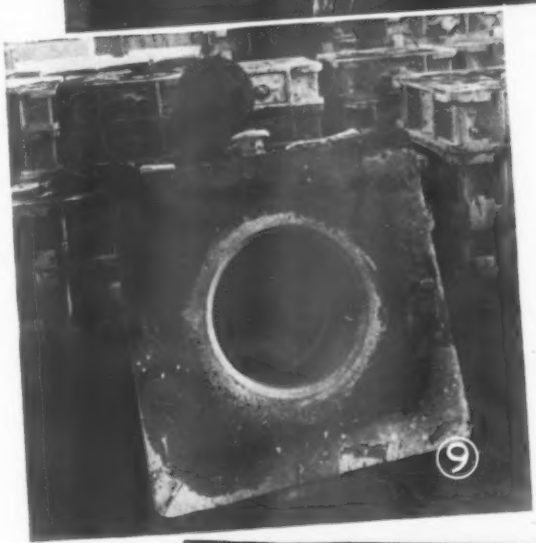

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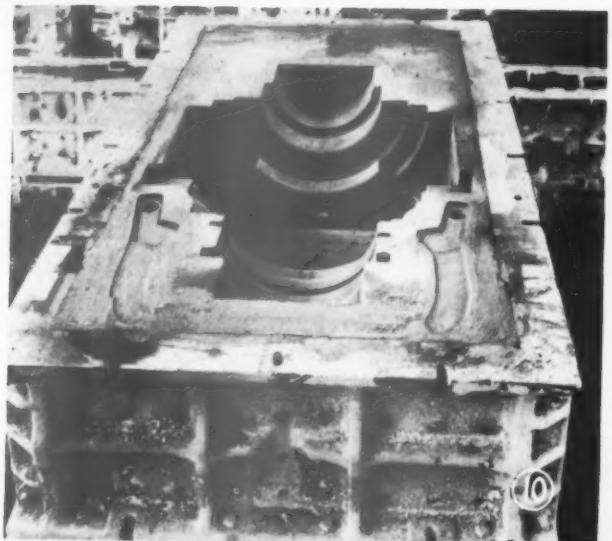

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Discussion of the effect of inoculation on gray cast iron is continued in this second of three articles on structure control. Choice of inoculant, amount to use, methods of adding it, and use in correcting analysis are described in this installment. The first section appeared in the February issue.

Structure Control of Gray Cast Iron

SINCE the effect of inoculation is to reduce the tendency of cast iron to exhibit type *D* or eutectiform structures, it is only necessary to know the detrimental effect of such structures in order to state the exact effect of inoculation. In general, the effect or influence of type *D* structures may be summarized as follows:

1. Type *D* structure decreases the tensile strength of cast iron to a greater or lesser extent depending upon the amount of primary ferrite present except in those cases in which the type *D* structure is confined to the skin of the casting, and therefore is removed during the machining of the tensile specimen.

2. It decreases transverse strength; usually to a marked extent because the structure is most prevalent at the skin of the test bar which is the area of greatest influence on the transverse test.

3. Deflection is reduced in direct relation to the amount of type *D* graphite.

4. Brinell hardness may be reduced if primary ferrite is present or may be definitely increased if the reading is affected by surface chill.

5. Chilling tendency or the tendency toward the formation of hard spot and chilled corners may be drastically increased.

6. Wear resistance is nearly always decreased and if primary ferrite is present the decrease becomes very pronounced. The presence of type *D* structures increases the tendency of an iron to scratch, gall, or scuff.

The direct effect of inoculation on mechanical and physical properties can then be summarized as follows:

1. Inoculation reduces the variation in mechanical properties such as tensile strength, transverse strength, deflection, and brinell hardness. Normally it increases all these properties except hardness. The effect on hardness depends upon the amount and type of inoculant used.

2. It reduces chilling tendencies and promotes a more uniform chill depth for any given composition. This is reflected directly in increased ease of machining.

3. It increases wear resistance by eliminating type *D* graphite and primary ferrite at the machined surface.

These effects of inoculation may have far reaching influence on other foundry considerations. As an example, the increase in uniformity of results permits the use of a *softer* iron to meet a given

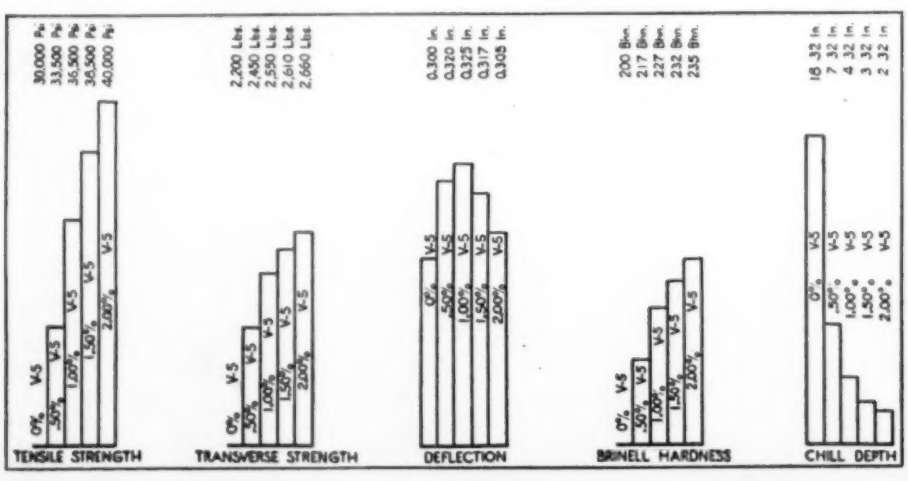
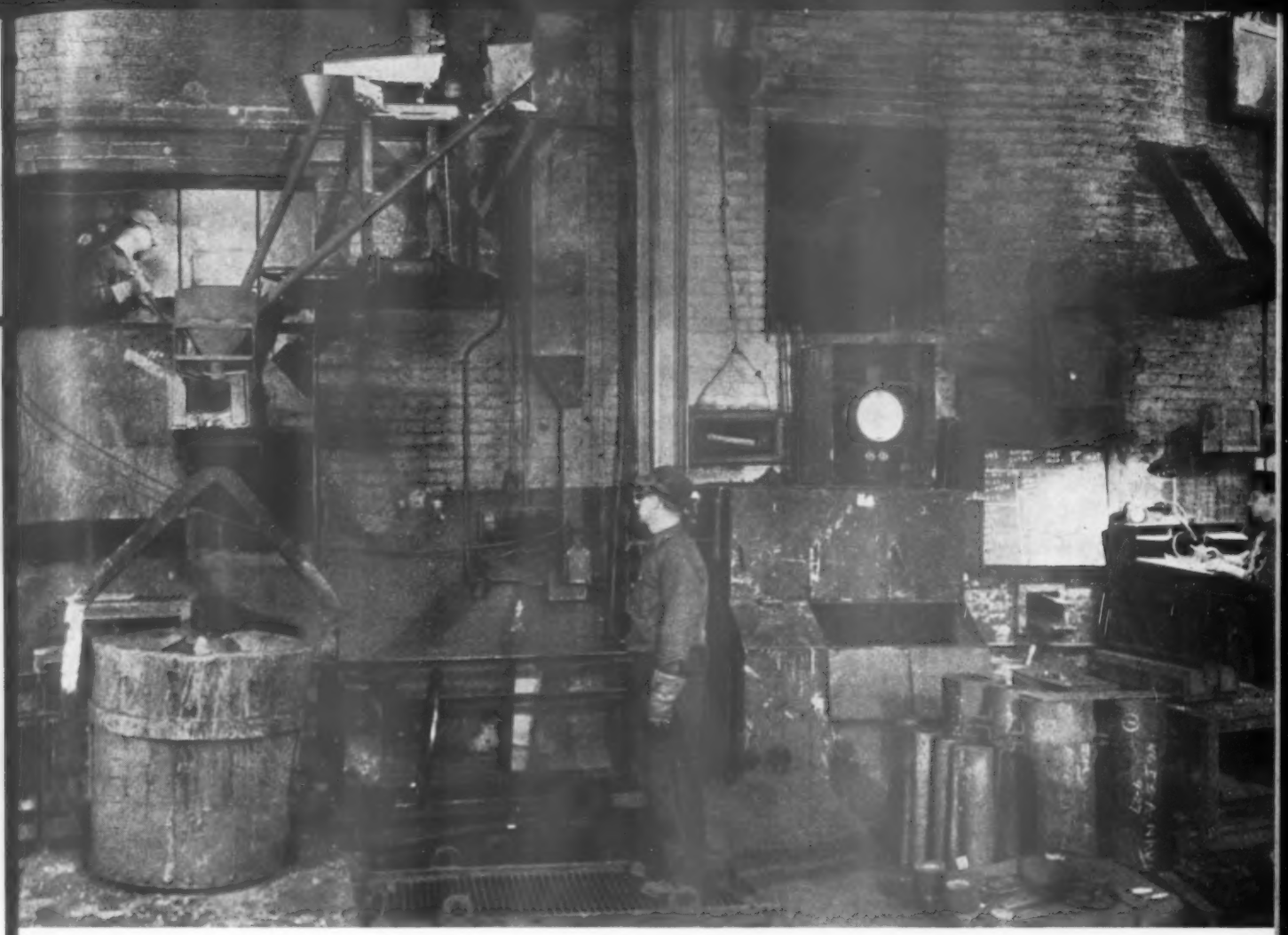


Fig. 7—Diagrammatic presentation of the effect of varying amounts of a stabilizing type inoculant on the mechanical properties of a base iron containing approximately 3.40 per cent total carbon and 2 per cent silicon



By R. G. McELWEE and TOM E. BARLOW
Vanadium Corp. of America
Detroit

Fig. 8—Calibrated vibratory feeders at upper left introduce inoculants to iron flowing in cupola spout. Feeders are supplied by gravity from hoppers on charging floor above. Metal tester at extreme right controls additions by means of electric timer. (Photo by courtesy Westinghouse Trafford Foundry)

mechanical property specification. This is due to the fact that the minimum values are raised. This is reflected in more economical utilization of the alloying elements since a large portion of the alloy is not wasted in strengthening the *off irons*. Conversely, the entire alloying effect can be concentrated upon raising the general level of the carbon-equivalent vs. tensile strength curve.

Inoculation promotes a reduction in the combined carbon of the lighter sections (which might normally be excessively hard) without reducing the combined carbon of the heavier section. Inasmuch as shrinkage is a direct function of the percentage of combined carbon in the iron, a reduction in the chilling tendency by inoculation results in an increase in the uniformity of structure from heavy to light sections. This effect provides a more uniform hardness throughout a given section, and reduces those internal shrinks which are due to variations in structure from section to section. A greater uniformity of shrinkage results, with a corresponding decrease in porosity. Stabilizing inoculants such as V-5 actually increase the hardness of heavy sections while reducing the chill of light sections so that a further increase in uniformity results.

After the necessity for inoculation is determined, the next logical step is to determine the type and amount of ladle inoculant to use in any particular application. There is no universal material which is suited to all applications, but certain general considerations are well established.

Possibly the first consideration in determining the type of inoculant is the range of analyses in which it will be used. This is illustrated in Fig. 5 (THE FOUNDRY, February, p. 113) which includes two entirely different types of material. The graphidox (silicon, calcium and titanium alloy) curve is typical of those materials which include predominating percentages of silicon or carbon, with or without other elements. The V-5 (chromium, silicon, manganese, calcium and titanium alloy) curve is typical of materials containing considerable percentages of carbide stabilizing elements such as chromium. It is apparent from these curves that in low carbon-equivalent irons the graphidox type may be more economical from the standpoint of tensile strength alone, while in the softer irons the V-5 type is definitely superior. On the basis of tensile strength alone then, the decision as to the type of material to use is relatively simple. However, other considerations may affect this (*Please turn to page* 163)

Selecting Evaluating and Specifying METALLIC MATERIALS

Abstracted from a report
By H. W. GILLETT

This second installment from a voluminous report prepared for the War Metallurgy Committee has been abstracted to present pertinent data relating to castings. It points out that certain properties of a material are of little value in determining its adequacy for a specific use, and discusses various determinations of the properties of metallic materials which are expressed in pounds per square inch. The first installment of this series appeared in the February issue, and the third will be presented in April.

DESIGN engineering consists in making each part of suitable dimensions and of suitable material to withstand the service stresses. To do this by true engineering rather than by guesswork requires knowledge of (a) the stresses to be imposed, and (b) the properties of the material in resisting those stresses. If both (a) and (b) are known, the dimensions can be calculated.

Knowing the permissible weight of the part and the available space into which it must go, its dimensions can be altered, as well as the dimensions of its mating parts. The properties of the available material must be such that the part made from it will not only bear the stresses safely but also will fit the space that can be assigned to it.

When a new material is to be substituted in a part of an old design where the dimensions cannot be changed, as in a repair part, the substitute material must be *adequate*. If it is adequate, *for that use* material *B* is an equivalent of material *A* previously used. All of the properties of *A* and *B* need not be identical, for *A* may have had an unneeded excess in some properties, or *A* may have had properties not called for. If the mechanical properties of *B* are adequate, it would make no difference for most uses whether the electrical conductivity of *A* was high and that of *B* low. On the other hand, it might happen that a similar coefficient of thermal expansion, for example, would be required.

Governed by Service Conditions

Adequacy cannot be appraised apart from the conditions of service. Equivalence connotes equal adequacy for service, and likewise cannot be considered apart from the conditions of service.

Appraisal of adequacy in design engineering should be in terms of stress and resistance to stress. When pounds, square inches, and pounds per square inch are the words in which requirements are set up, and in which properties are reported, there is no ambiguity, materials are chosen, specified, tested, and accepted on a sound engineering basis.

When other attributes than strength are required, for example, resistance to corrosion, then analogous concepts, intensity of attack, ability to resist, and area available for resistance, are called for. (*Please turn to page* 166)

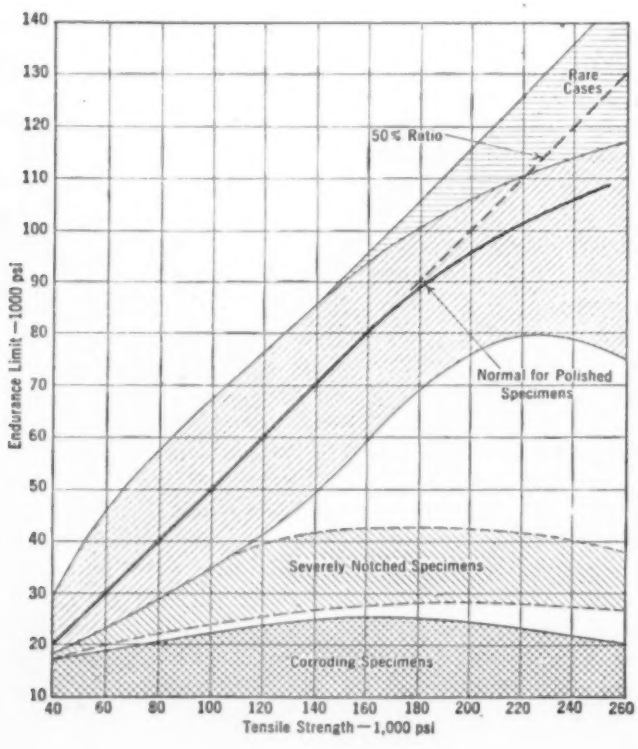


Fig. 3—Diagram indicating the general behavior in fatigue in relation to tensile strength of polished, notched or corroded specimens of steel. (From reference 11. Note the scatter band)

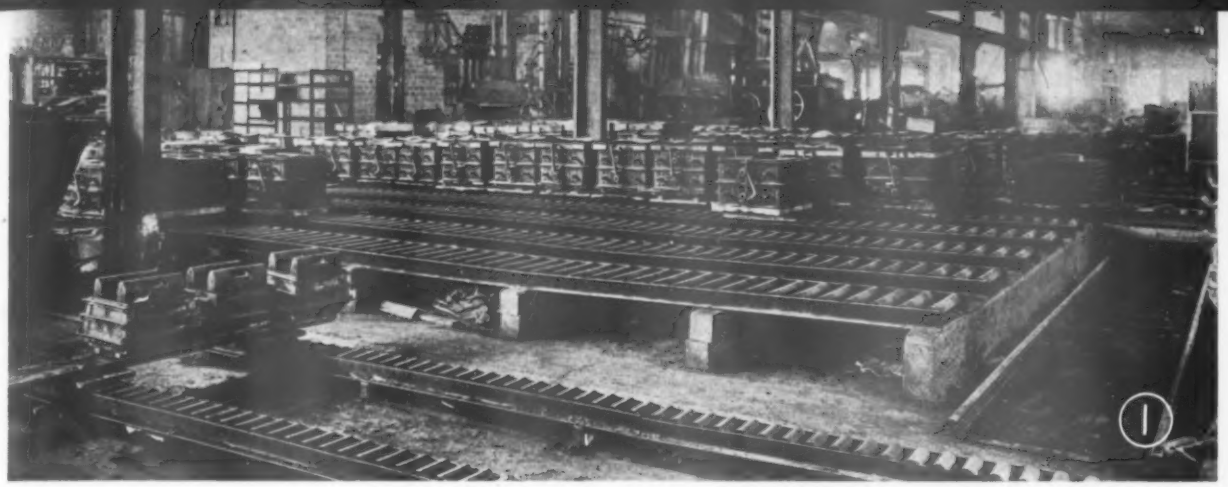


Fig. 1—Molds from a battery of molding machines in the side bay are placed on a transfer car operating on a track which passes long inclined gravity conveyor lines

Makes the Most of Floor Space

By Pat Dwyer

EXTENT to which a foundry can be pushed by skillful management to meet emergency conditions is exemplified to a remarkable degree in the plant of the St. Louis Steel Casting Co., St. Louis, where monthly production of small and medium size steel castings has been raised from 175 to 550 tons. For purpose of comparison it is interesting to note that the floor space devoted to molding and pouring is 68 x 160 feet or 10,880 square feet. On the basis of the average 25-day month this means that 20 tons of castings are produced each day, or 1 ton per 544 square feet of floor space. Explanation lies in the fact that the greater part of the floor supports roller conveyor lines on which the molds are placed, poured and removed to make place for others several times during the day. In this manner, the available floor space, instead of being utilized only once, becomes equal to a floor many times the size.

Since the average yield of castings in proportion to the amount of metal melted in a steel foundry working on a miscellaneous line of castings fluctuates between 60 and 70 per cent, it is apparent that the single electric furnace, normally rated at 6000-pound capacity, is pushed to the peak to melt approximately 27 to 30 tons every 24 hours. Requirements are met by melting 13 3-ton heats in every 24-hour period, 6 days per week. On Sunday the furnace is overhauled and repaired and made ready for another week's strenuous campaign.

General layout of the foundry is shown in the accompanying free-hand sketch which makes no pretense of being drawn accurately to scale. It will be noted that all raw materials enter the building near the center of the west side, and the finished castings leave the building from the shipping and inspection department at the northeast corner. Recently the congestion in this particular department was relieved by the erection of an inspection, storage and shipping room a short distance across a driveway from the old shipping room. In some instances castings are allowed to accumulate until an order is filled. However, in the majority of instances the customer is prepared

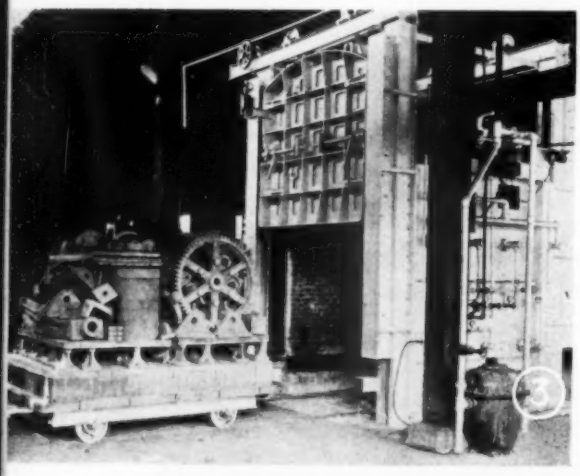
Fig. 2—An air hoist suspended from a jib crane lifts the loaded pans and tips the charges into the furnace

to accept truckload shipments from day to day. The castings enter this building at the street level and are lifted to a second level or loading dock for final inspection and storage. From there they are loaded and shipped out on trucks whose floors are on the same level as the floor of the loading dock.

Sand, clay, bricks, scrap and other raw materials arrive on railroad cars and are unloaded into suitable bins on the west side of the building. The entire area is walled and roofed to protect the sand from the weather and to facilitate the work of the men making up the furnace charges. A belt conveyor and elevator transfer the sand from the bins to large storage hoppers above the muller type sand mixers, and another bucket elevator and long belt supply the prepared sand to the hoppers above a battery of molding machines extending in a long line at the east side of the main or center bay of the foundry. The hopper on top of the sandslinger at the extreme south end of the foundry is served in a similar manner. Prepared core sand is loaded in tote boxes and carried by one of the cranes to the storage hoppers above the benches in the core room.

The main bay of the foundry is served by three electric traveling cranes, two of 5 tons, and one of 7½ tons lifting capacity. A lighter crane spans the side floor molding bay, and a similar crane does duty in the cleaning room. A number of jib cranes attached to the building columns at strategic points and equipped with electric hoists, handle local loads and relieve the traveling cranes of a considerable amount of miscellaneous work. One of these cranes may be noted in Fig. 2. The furnaces are mounted back to back, so that if necessary, the crane can discharge a load into either one. The same illustration shows part of the industrial track extending across the building and out into the stock building, where it is connected by turntable to another section of track at right angles and extending to the end of the stock building.

Scrap metal from piles on both sides of the track is loaded by hand into long steel troughs mounted on small buggies. Each load is weighed accurately on a track scale, and a certain amount is added or removed to meet requirements. Since the furnace is acid lined, the selection of stock and the final composition of the charge is watched more closely than is necessary with a basic lined furnace. This feature of course is familiar to steel foundrymen; the comment is for the benefit of readers who may not be familiar with steel foundry practice. The troublesome elements, sulphur and phosphorus, can be reduced to the required amount in a basic furnace. In an acid lined furnace, these elements are not affected and remain substantially the same as they are in the material charged into the furnace. (*Please turn to page* 179)



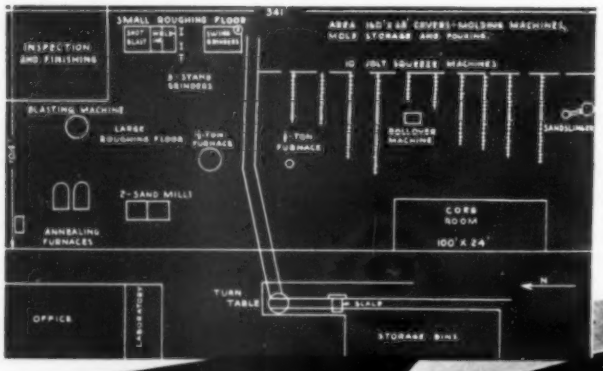


Fig. 3—A platform mounted on pedestals above the car top permits uniform distribution of heat around the castings. Fig. 4—Hoppers at one side of the main bay deliver sand to the coremakers in the side bay. Fig. 5—Castings are carried on conveyors to the various chipping and grinding stations and eventually to a long conveyor which delivers them to the shipping department

Heat Treating Bronze Castings

By
J. W. HORNER and FRANK A. MASON
Stack-Horner Brass Mfg. Co., Denver

HEAT treatment to cure porosity in some classes of bronze castings is applicable only to a certain condition of the metal structure, and this article does not intend to imply that all casting faults can be corrected by this process. The process, which will be described later, can be used only on castings that are structurally sound and are made by satisfactory foundry methods.

To study this need and application of the treatment, a brief picture of the need for good foundry practice will help to visualize the problem in the mind of a progressive foundryman.

Reasons why a casting will leak under pressure include: Lack of feeding or proper gating; poor design and pattern construction; gas or steam porosity; dirty metal, or dirt from mold or core washings; impurities in the metal; dendritic unsoundness.

To take care of the additional metal required by a casting during the solidification process (or shrinkage), proper feeders must be placed at the sections requiring metal. In most cases, these feeders are located at heavy sections. Very seldom is it necessary to feed light sections. For valves with large flanges, the feeders (or risers) are attached to the flanges to insure maximum feeding in the castings. Sometimes these heavy sections are located at points where feeding with risers is not satisfactory, and chills must be applied. A globe valve with a diaphragm heavier than the surrounding bowl may be cited as an example. Sometimes risers located in position to feed in the direction of the diaphragm will solve the problem.

The pressure system of casting without risers, has certain applications to pressure tight castings. The principle of this process is to provide sufficient pressure through a high pressure head. Theoretically, this high head produces a hydraulic pressure transmitted to all parts of the liquid metal, and then being small in area, the sprue freezes under pressure. Without doubt this system has many commercial values, but good clamping and flask equipment are necessary to withstand high pressures generated by the pressure heads. Good equipment to remove heavy risers is necessary to produce castings at a reasonable cost.

In the foundry of the Slack-Horner Brass Mfg. Co., Denver, a system of risering and gating has been set up to provide proper feeding for pressure castings. Gates are designed so that the metal can be poured and distributed to all sections of the casting as rapidly as possible. All the heavy flanges, or sections, are provided with risers located on the flat side of the flange (not the edge) in such a way that they also provide a direct passage of feeding metal to the light bowl section and diaphragm or heavy internal section of the casting, as well as to the flange itself.

Defects caused by faulty risering or feeding cannot be remedied by heat treatment. These defects produce cracks, fissures, tears and strains in the physical structure. Defects of this type must be overcome by good foundry practice, and that is outside the scope of this article, which was prepared primarily to describe a successful heat treatment process.

Design plays an important part in the production of good castings. Round corners; good filleting where sections meet at sharp angles; and gradual changes from heavy to light sections are components of good design.

The pressure product should be designed for economical foundry and machine operations. In most cases during the past, the product was designed for use. Foundry and machine work had to be adjusted to suit the design. In peacetime, when the finest of metals could be obtained, and when wages and time were less valuable, this factor was not so important.

Sharp corners actually affect the crystal structures, and there is a tendency for one section to draw or shrink away from the other. Where a heavy section is attached to a light section, it is necessary to relieve this abrupt change by fillets. Fillets act as shock absorbers during the cooling cycle. Good design aims at making the whole casting as nearly even in section as possible.

In the opinion of the authors, valves and many pressure castings should be redesigned for more efficient production. Many valves for the United States Navy are poorly designed. Some of the designs are more than 25 years old. The foundryman should have a sayso in a design for a new style.

Gas and steam developed during the casting process are common causes of leakage in pressure castings. Good melting control and proper condition of the core and molding sands will eliminate troubles caused by steam and gas.

Combustion gases sometimes are absorbed by metal when the furnace atmosphere is not controlled, or when the metal is allowed to soak or overheat. The absorbed gas remains in the metal until the casting is poured, and during solidification it escapes leaving hundreds of tiny pin holes in the cast structure which are readily seen after machining. (*Please turn to page* 187)

Plan A.F.A. Congress TO AID WAR PRODUCTION

TIMELY and practical information that foundrymen can put to immediate use in production of cast metals for war purposes will feature the technical program of the Third War Production Foundry Congress of the American Foundrymens Association, to be held at Buffalo, April 25-28. The high caliber of papers to be presented, plus exhibits of materials and equipment for foundry use, are expected to be big drawing cards for this meeting, which is the 48th Annual Convention of the association.

A large number of exhibitors will display their products and services, including not only most of those firms who exhibit regularly at foundry shows but also a large number of new faces. It has been announced by A.F.A. officials that the number of exhibitors at the Buffalo Foundry Congress will be greater than for any previous convention since the big event held in 1930 at Cleveland.

Exhibiting companies are expected to concentrate their efforts on displaying improved and new products which provide maximum value to the wartime production of castings. A number are planning, as in 1942, to offer their services as "conference clinics," although the majority will display equipment and materials, with operation of limited mainly to demonstrations of working parts and the like.

Although the congress and show proper are scheduled to start Tuesday morning, April 25, all exhibits will be opened for a "Buffalo Preview" from 6:00 to 10:00 p. m. Monday, April 24. These previews, which proved so popular in 1938, 1940 and 1942, give local plant men an opportunity to inspect the latest advancements in equipment and materials, especially men who are unable to attend during the regular congress program. In many cases, men attending the preview report back to their operating supervisors on particular exhibits they consider of greatest application to their own work.

Admission to the preview night will be entirely free on presentation of invitation cards distributed by the national office of A.F.A. in Chicago and through members of the Western New York and Rochester Chapters. Attendance at the preview held in Cleveland 2 years ago ran into the thousands, and the outlook for this year's advance event is considered equally bright.

Papers scheduled by the A.F.A. Aluminum and Magnesium Division for the Buffalo congress cover a broad field of processes. Subjects to be considered include the effect of alloying elements; the cold-chamber die casting process; controlled directional solidification in plaster molds; determination of permeability of plaster molds, and micro-radiography as a foundry tool. In addition, the annual exchange paper from the Institute of British Foundrymen, prepared by John Vickers, Rolls-Royce Ltd., England, will deal with permanent mold castings.

One of the features of the malleable iron program will be papers on melting practices and control. A symposium of nine papers dealing (*Please turn to page* 142)

RAPID DETERMINATION OF Chromium, Nickel and Manganese

By R. H. JACOBY
Key Co.
East St. Louis, Ill.

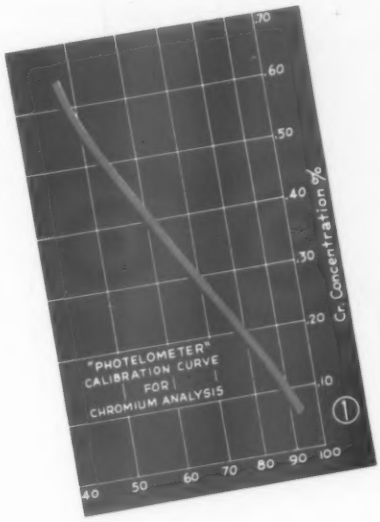
ALTHOUGH the described methods for determining chromium, nickel and manganese are not entirely new, having been routine practice in at least two middlewestern steel foundries for the past 3 years, the writer believes that, considering local interest evidenced in adopting the methods and the increased need of speed and importance of determining residual alloy percentages in ordnance work, additional publicity is in order.

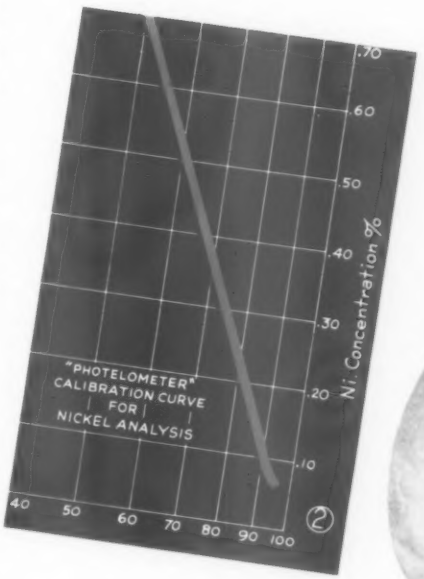
Equipment necessary for the procedures includes: Sheard-Sanford Photelometer (green filters). Pyrex volumetric flasks, total phosphoric acid type, sizes 100 milliliter and 250 milliliter (can be obtained from Central Scientific Co. under catalog No. 16290). The 100 milliliter size is special make. Narrow spatula stainless steel or glass.

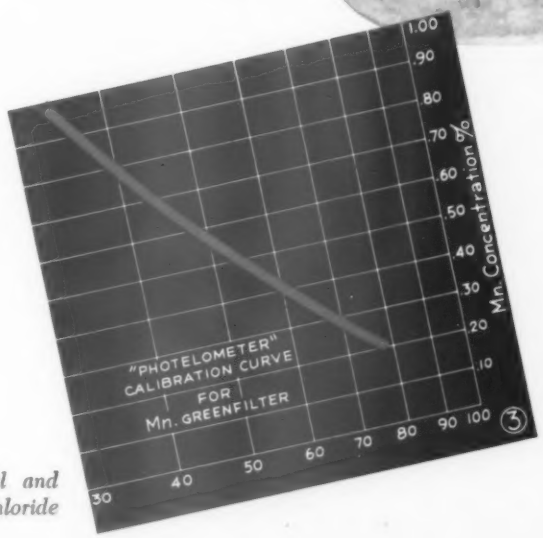
Suggested equipment to speed up work: Dispensing burette (fits directly on Baker's or General Chemical Co. screw-type acid bottles). Automatic pipette in 25, 50 or 100 milliliter size which has 2-way valve and aspirator bulb for filling.

For those not entirely familiar with the equipment, a few notes on the Sheard-Sanford Photelometer follow:

The photelometer employs the principles of spectrophotometry and is not a development from the visual colorimeter. In spectrophotometry, concentration of a substance in solution is determined from transmission values for a narrow band of wave lengths within a characteristic absorption band for the substance. The apparatus simplifies spectrophotometrical procedures, as elaborate equipment for segregating a spectral band for transmission measurements is not required. The spectral bands are selected by means of optical filters which limit the transmitted light to a relatively narrow spectral region. Thus, by using only the light which is included in the wave length range comprising the absorption band of the component being measured, the greatest change in transmission occurs with the change in concentration of the component. Measurement of the percentage of light







Figs. 1, 2 and 3—Calibration curves for chromium, nickel and manganese to be used with the instrument. Fig. 4—Sodium chloride added from spatula while sample is boiling

transmitted by the solution is made by means of a photoelectric cell and microammeter. The instrument is obtained without calibration to permit the user to calibrate with standard samples of known content and establish a curve on the logarithmic paper furnished with the instrument.

In use, a small amount of the solution is transferred to a glass cell with plane, parallel sides. The cell is inserted in the photelometer, and the microammeter indicating arrow is adjusted to zero with a cell of distilled water in place which would give 100 per cent transmission of light. Movement of the carriage puts the colored sample in place and cuts down on the intensity of light proportionate to the amount of determinable component present. The reading is taken and the corresponding percentage read from the curve.

Determination of chromium by use of a green filter will produce results accurate to within plus or minus 2½ per cent, and can be run completely through in less than 10 minutes.

Procedure is to dissolve the sample in 20-30 cubic centimeters of perchloric acid plus a few drops of hydrofluoric acid. Heat until heavy fumes of perchloric acid appear in top of flask. Remove, cool, dilute as specified in Table I. Take 10 or 25 cubic centimeters as specified and dilute to about three-fourths of specified amount. Add 25 cubic centimeters of perchloric acid plus 10 cubic centimeters of indicator, complete dilution, shake well, and read in photelometer.

Special precautions to be observed are: *Be sure to add acid as specified to second dilution.* Color which develops slowly is a sign of low acid concentration. Indicator must be made up fresh every 4 hours, and kept in a dark bottle and in *cold water.*

Solutions required are: Perchloric acid—60 per cent technical grade. Indicator—saturated solution of diphenylcarbazide in ethyl or isopropyl alcohol.

The figures given in Table I may be varied in any manner so long as a conver- (*Please turn to page* 178)

Table I—Weights and Dilutions for Chromium

Chromium Per Cent	Weight Gram	Dilution c.c.	Factors (in terms of Cr)
0- 0.5	1.0	500-25-500	Straight
0.5- 1.0	0.5	500-25-500	x 2
1.0- 2.0	0.25	500-25-500	x 4
2.0- 5.0	0.1	500-25-500	x 10
5.0- 10.0	0.1	1000-25-500	x 20
10.0- 20.0	0.1	1000-25-1000	x 40
20.0- 50.0	0.1	1000-10-1000	x 100
50.0-100.0	0.05	1000-10-1000	x 200

Table II—Weights and Dilutions for Nickel

Nickel Per Cent	Weight Gram	First Dilution c.c.	Second Dilution c.c.	Multiple (in terms of Ni)
0.00- 1.50	0.5	500	25 to 100	2
1.50- 3.00	0.25	500	25 to 100	4
3.00- 8.00	0.1	500	25 to 100	10
8.00-16.00	0.1	500	25 to 200	20
16.00-40.00	0.1	1000	25 to 250	50
40.00-80.00	0.1	1000	25 to 500	100

Table III—Weights and Dilutions for Manganese

Manganese Per Cent	Weight Gram	Dilution c.c.	Factors
0- 1.0	0.2	100	straight
1.0- 2.0	0.1	100	x 2
2.0- 5.0	0.1	250	x 5
5.0-10.0	0.1	500	x 10
10.0-20.0	0.1	1000	x 20

Fig. 5—Wide mouth pyrex volumetric flask used for direct solution and dilution of sample

Fig. 6—Adding perchloric acid or periodate solution. Use of dispensing burette speeds up this step

Fig. 7—Filling the cell after dilution of specimen to specified volume. Fig. 8—Making the reading on the instrument scale

Ferrous Industry Advisory Committee of the War Production Board recently received this report of a series of tests run by one foundry in an effort to increase the use of alloy steel scrap

Utilizing Alloy Steel Scrap

By VICTOR E. ZANG
Unicast Corp.
Toledo, O.

ELECTRIC foundries with the smaller melting units on being faced with the problem of using their own remelt, plus 8 per cent alloy turnings in alloy melts under Order M-21-a, have frowned on using additional alloy scrap. The melting of these turnings imposed considerable hardship and chance, due to bulk, erratic analysis, and retained cutting oils. *Bulk* (low poundage per cubic foot of charged material) caused back charging with loss of time and hazards from flying molten metal. *Erratic Analysis* gave difficulty in figuring analysis, and thereby limited the amounts of alloy steels that could be used in conjunction with them. *Oils*, unless degreased or burned off, caused increased carbon with increased melting and refining time, as well as possibilities of sulphur pick-up.

TABLE I

Resume of 100 Heats of Alloy Steels

Scrap Charge	Pounds	Percentage
Total Scrap	1,171,900	100.0
Foundry Remelt Alloy	490,500	41.9
Foundry Remelt Carbon	24,500	2.1
Purchased Alloy	544,900	46.5
Purchased Carbon	112,000	9.5

TABLE II

Chemical Range for Each Element

Element:	Carbon	Manganese	Nickel	Chromium	Molybdenum
Range:	0.27-0.37	0.75-0.85	0.60-0.90	0.40-0.60	0.17-0.27
Withins:	93 per cent	92 per cent	67 per cent	98 per cent	95 per cent

TABLE III

Average Analysis of 11 Cars of Scrap

Car	Specifications	Nickel	Chromium	Molybdenum
A	SAE 4340	1.62	0.62	0.29
B	SAE 4340	1.84	0.66	0.24
C	SAE 4340	1.86	0.68	0.25
D	SAE 4340	1.68	0.60	0.19
E	SAE 4340	1.56	0.58	0.35
F	NE 8600	0.42	0.32	0.32
G	NE 8600	0.50	0.36	0.33
H	NE 8600	0.38	0.33	0.20
I	Moly Plate	...	...	0.29
J	Moly Plate	...	...	0.30
K	Moly Plate	...	...	0.21

TABLE IV

Tests on Oil Quenched and Drawn Steels

Brinell Hardness	Tensile	Yield	Elongation Per Cent	Reduction of Area Per Cent
207	100,000	75,000	25	45
217	105,000	77,000	23	45
228	110,000	85,000	19	45
241	115,000	90,000	19	42
255	120,000	95,000-100,000	17	40
269	125,000-130,000	105,000	17	35

Recently a 90-day relief from M-21-a was permitted to experiment on making alloy steels with the maximum alloy steel scrap charges. A resume of 100 such heats melted in a period of 17 days is shown in Table I.

Use of some carbon steel scrap is necessary to adjust chemical compositions, as these heats are melted without the use of any additions of virgin alloy.

When first starting this procedure, considerable difficulty was encountered in adjusting charges to maintain a desired composition. However, it is believed that this now is well overcome, and charging instructions are given so as to maintain a specific range that meets all physical requirements.

The chemical range, with the percentage of "withins", for each major element is listed in Table II.

It will be noted that nickel is the hardest element to control, the reason being a variation of as much as 0.30 per cent of this element in scrap steels when purchased under the same specifications, while other elements maintain a much narrower range. To show chemical variation, typical average analyses of 11 cars of scrap received during this trial are given in Table III.

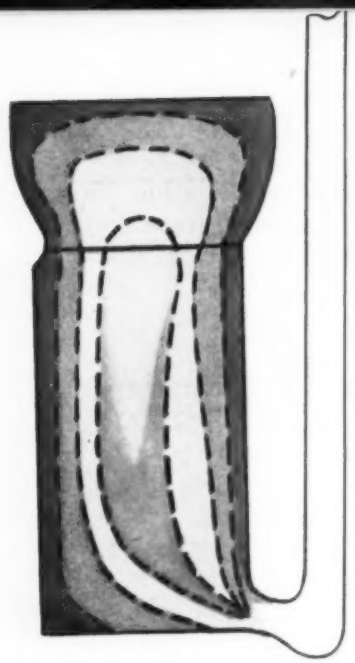
Sampling procedure has been found important in the maintaining of proper scrap piles and charges. When cars contain only one type of scrap, two samples are selected and analyses run in duplicate on each sample. When several types of scrap are received in one car, two samples of each type are analyzed in duplicate and the entire lot averaged. Scrap is then grouped according to the average analysis. For example, in the preceding analyses three groups have been used:

Scrap is charged by magnet into charge buckets, in accordance with instructions issued by the laboratory. Charging instructions vary according to analysis of scrap, and the quantity of foundry alloy remelt to be consumed. A typical charge is as follows:

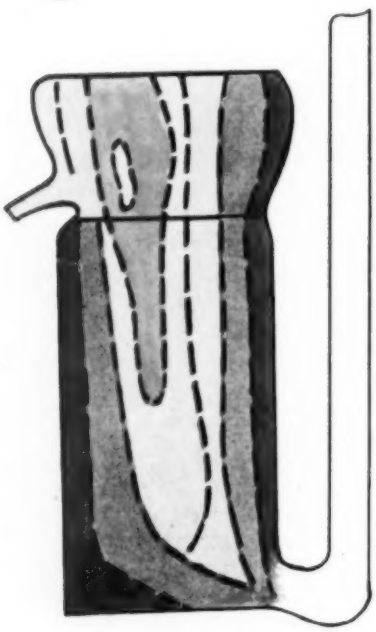
	Pounds
Foundry alloy remelt scrap	4,000
Moly Plate (purchased) scrap	1,000
SAE 4340 (purchased) scrap	4,000
NE 8600 (purchased) scrap	1,000
Carbon (purchased) scrap	2,000
Total	12,000

This type of melting has produced a steel that meets all QQS-681-B, 4B series and 4C series up to 4C3, consistently and regularly, by (*Please turn to page* 134)

Factors in the Production of quality c

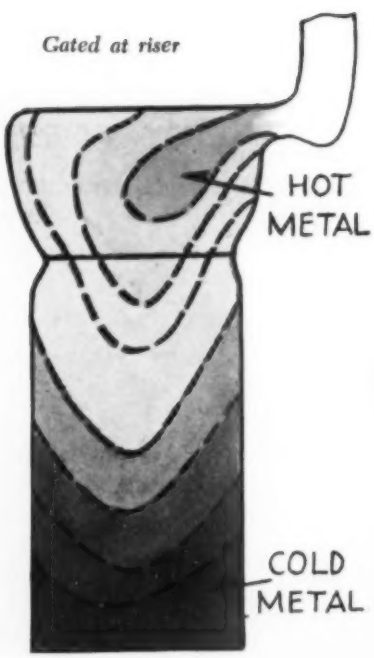


Bottom gating



Bottom gating with run-off at riser

Gated at riser



IN SPITE of all the present knowledge on the subject, internal shrinkage and sponginess in castings still is with us. It has been a major foundry problem since the first castings were made and it still is the cause of thousands of rejects every day.

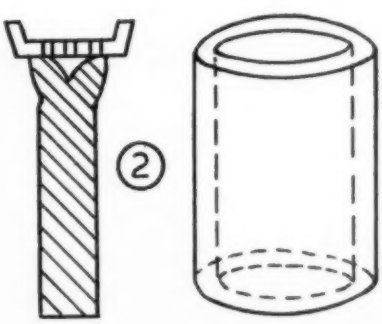
Production of sound castings is of prime importance. High strength iron mixtures and the use of alloys play a very valuable part in the industry, but the fact must be recognized that these foundry tools are worthless until a solid casting can be produced. The first requirement is a design to which the principles of *controlled directional solidification* may be applied. If this is not possible with the design as originally produced, a few slight changes may be required.

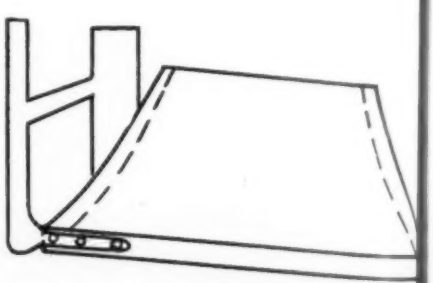
When metals solidify they contract, and it should be recognized that cooling starts at the surface and progresses toward the center. When this phenomena happens a shrinkage cavity occurs equivalent to the contraction of the metal.

Controlled directional solidification is successful only when certain principles of casting design are adopted. These principles stress the importance of feeding smaller sections through heavier ones. Only when the temperature gradients within the metal and the mold are such that the feed heads are the last portions of the casting to solidify, and thus can furnish liquid metal to fill the voids formed during solidification, can a sound casting be produced.

To prevent isolated hot spots in the casting it should be designed so that the shrinkage can move progressively from all members of the casting to the riser. From this standpoint the best designed casting is the one in which all members increase progressively in thickness to one central location where a riser can be placed. If demands

Fig. 1—Cross-section of solidifying metal showing effect of gating on temperature differential. Fig. 2—Direct riser pouring. Figs 3 and 4—Indirect riser pouring. Fig. 5—Partial reversal method of gating and risering





By WILLIAM G. REICHERT
W. G. Reichert Engineering Co.
Newark, N. J.

y castings

This second of three articles on quality casting production discusses causes and methods of correcting internal shrinkage and sponginess in castings, and explains the effect of different gating systems on metal solidification during the freezing process.

make it impossible to permit this gradual and progressive tapering of all sections to a common point it is necessary for the foundryman to provide additional reservoirs of metal to supply those sections which are cut off from the central riser.

Factors affecting the formation of hot tears in steel castings include:

1. Contraction stresses, caused by mold resistance or by uncontrolled directional cooling.
2. Pipes or cavities.
3. Physical properties of the steel, principally the strength at solidification temperatures, and fluidity.

Mold resistance is very conducive to the formation of hot tears. The fact that some sands are considered non-collapsible at elevated temperatures and resist the contraction of the steel is not the entire story. The mold hardness and the quantity of sand around the casting also are important.

Cores especially are responsible for mold resistance. Iron core bar and reinforcing bars offer a resistance difficult to overcome. Castings that crack in dry sand may not crack in green sand due to the fact that the rate of collapsibility is greater in green sand.

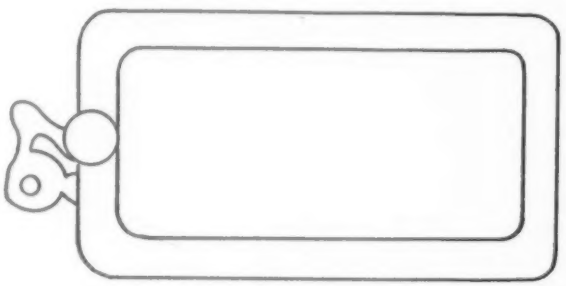
In many cases stresses are concentrated by the methods in which the metal solidifies, and the concentration of these stresses is caused by uncontrolled directional solidification. If no thought is given to the rate of solidification of the various sections, the metal will solidify so that a thin section which has solidified completely will pull away from the heavier section which is in the critical solidification range and susceptible to crack formation.

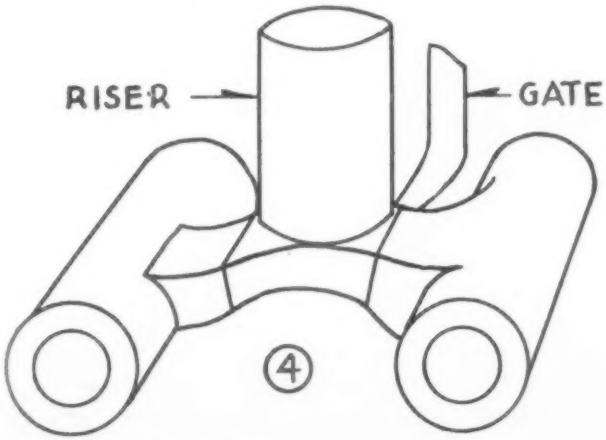
Pipes and small cavities are factors in the formation of hot tears as they become centers of stress concentration. Pipes and cavities often form at the last point of solidification of a section and usually are the weakest point of the casting. It is well known that all types of cavities are points of stress centralization and thus the two factors of metal weakness and stress concentration produce hot tears and cracks. Abrupt changes in sections are centers for stress centralization, and if there is a lack of control in directional cooling, pipes and cracks will form.

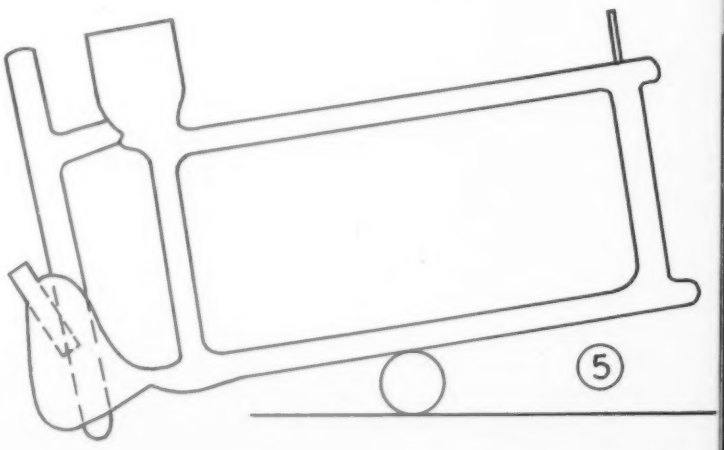
The importance of obtaining fluidity has been emphasized because a smaller percentage of defects will be found in castings poured with a more fluid metal. The greater fluidity allows for better controlled directional solidification and the possibility of filling the cracks. If a crack should form in a part of a casting already solidified and the crack extend to liquid metal, then the greater fluidity of the steel, the more opportunity there is for the crack to become completely filled.

Measures employed to eliminate hot tears include the following:

1. Collapsible molds and cores.
2. Use of chills at the proper sections.
3. Application of ribs and wedges at certain changes of cross section. This does not eliminate the contraction stresses, it merely tends to prevent these stresses from centralizing at one point and rupturing the casting. The strength added to the surface skin by the presence of ribs acts to transfer converging (*Please turn to page* 190)







Makes Water Cooled Mold for Producing Grate Bars

Q.—We are contemplating production of sawmill grate bars by die casting, but have had little experience in such work, and can find no information on the subject. The grate bar weighs 77 pounds, is 3 feet long, 3¼ inches overall width, and 4¾ inches deep in the center. Used for burning sawdust, the grate has a triangular slot down the center ⅜-inch wide at the top and 1-inch wide at the base. We have made a welded steel, water-cooled manifold die in two pieces similar to a regular molding box. The drag takes the casting while the cope is a plain flat water jacket which is removable so that the water-cooled drag can be tipped over. Our problem is whether we can pour our iron into this die without condensation on the walls causing an explosion, or should the water be heated to around 100 degrees Fahr. before entering the mold. What should the die face be coated with to prevent the casting sticking?

A.—The term die casting to us implies the production of castings in metal molds, accurate in dimension by applying pressure to the molten metal. Your description of the process to be used seems to indicate what ordinarily is called permanent mold casting. You do not mention why you want to use a metal mold, but presumably it is to obtain either a fine grain structure, or a white fracture casting since it hardly seems possible that the grates have to meet close tolerances on dimensions. Also you do not give sufficient detail on the construction of the mold, but your reference to a coating leaves the impression that the slot in the casting will be formed by suitable metal projections in the drag mold.

While we do not think that you will have to worry about condensation of moisture on the mold face unless the circulating water is quite cold, there are other factors which may prevent successful use of the mold you describe. Rolled steel has a tendency to warp when subjected to elevated temperature on one side, and the mold could only be used a few times. If the mold is not baffled properly in the interior, the cooling will not be uniform and cause trouble—particularly in the projections forming the slots in the casting. Pockets of steam may form in those, and cooling would be negligible—not to mention the possibility of the molten iron cutting through the steel plate unless it was heavy. You also may run into trouble due to the casting gripping the part of the mold which forms the central slot so that the two cannot be separated without hammering or pounding.

As far as a coating to prevent sticking is concerned, a variety of materials are used in foundries for covering chills. Sometimes a coat of thin oil will serve while others prefer ordinary foundry blacking. In other cases a small amount of iron oxide mixed with oil is employed, and can be purchased already prepared. A thin clay wash also may be used. In case where the coating contains moisture, it should be dried well before being covered with molten metal.

Unless there is some definite reason for using the type of mold you describe, we suggest that you try making the grate bar castings in green sand. Use iron low in silicon or add some ferrochromium to obtain a hard iron as it is termed in the foundry. With sufficiently low silicon or enough ferrochromium, a completely white structure throughout can be obtained. If it is desired to have only the top or operating face of the bar fine grained or white, use a cast iron chill plate as the cope; the heavier the plate, the greater the chill.

Fractured Surfaces of Bronze Have Different Structure

Q.—We are forwarding two pieces of 85-5-5-5 bronze cut from the riser on the side of a 100-pound ring casting 18 inches in diameter. The two pieces show different grain structures. The castings leak when subjected to 100 pounds water pressures. The metal is poured through a single sprue and four small branch gates at one side, and at a temperature of 2100 degrees Fahr.

A.—A great deal more attention must be paid to castings subjected to pressure test, than to castings which merely have to present a suitable surface and ordinary freedom from pin holes or visual porosity. In the present instance the metal apparently is of the proper composition and was melted in a satisfactory manner. The difference in grain structure in different places resulted from variation in cooling time while the metal was solidifying. To insure uniformity in this respect the casting should be gated through an almost continuous circle of small gates, and the metal should be poured from two crucibles at opposite sides. This will insure metal of a uniform composition and temperature in all parts of the casting.

The two risers attached to the bosses on opposite sides of the casting should be at least twice the present size in cross section and should be touched up with hot metal for the last 3 or 4 inches. As it is now, comparatively cold metal enters the risers and they cannot function prop-

erly. The casting freezes at the bottom and the riser freezes at the top and in the body. The metal in the section between these areas cools at the slowest rate and consequently shows the rough structure.

Blower on Coke-fired Furnace Will Increase Combustion

Q.—Can you give us any advice on blower equipment to be installed on a coke-fired crucible furnace? We understand that with a centrifugal fan to supply a forced blast, rapid melting can be secured. What is the air pressure, and the amount of air in cubic feet per minute required for a fast melt in a furnace using a No. 60 to 80 crucible?

A.—So far as we know there is no recent, accurate data on the amount of coke required to melt, say 100 pounds of brass, but we recall that a figure of 25 pounds has been suggested as the quantity for a natural draft, coke-fired furnace, and between 10 and 15 pounds for forced draft furnace, or an average of 12.5 pounds of coke per 100 pounds of metal. Assuming that it takes 45 minutes to melt the first charge of 240 pounds of metal, then 30 pounds of coke would be burned in 45 minutes or 0.67-pound per minute. Since it requires about 132 cubic feet of air to burn 1 pound of coke, the blower would have to supply around 88 cubic feet of air per minute. Allowing 50 per cent excess since complete combustion does not function according to the theoretical considerations, the blower should supply 132 cubic feet per minute. Pressure should be low in the range of a few ounces.

As previously mentioned those figures are not to be taken as the last word since it may be possible to melt with less, or require more coke than the quantity selected. Also if the air blast is preheated before entering the furnace, more rapid combustion and greater efficiency will be obtained. Hence, it will be wise to install a gate in the line between fan and furnace to control the blast.

In the final analysis we believe that you would be much better off to purchase a forced draft furnace from firms who make a business of designing and constructing them. Any of the firms advertising the THE FOUNDRY will be glad to supply you with all available information on its coke-fired furnaces.

Increasing Impact Properties At Low Temperatures

Q.—We understand that the low-temperature impact properties of malleable cast iron can be increased by some type of additional heat treatment. Can you give us any information on the procedure?

A.—In an investigation of malleable cast iron properties conducted by Simmons, Rosenthal and Lorig, which was published in the October, November and December issues of THE FOUNDRY under the title, "Study Malleable Castings Properties for Military Applications," mention was made that in some cases beneficial results were obtained by an additional heat treatment and quench. More specifically, on page 190 of the November issue the authors state:

"The so-called 'Flecto' treatment, i.e., air or water quenching of the test bars from 1200 degrees Fahr., led to variable results. Notched bar charpy values for iron B were raised quite markedly and the sudden drop-off in the double width bars at about —40 degrees Fahr. was eliminated. Charpy values for irons A and G also were raised somewhat by the heat treatment. For the other irons and other mechanical properties, no gains of any consequence could be observed, although there was some indication that the tensile-impact values for iron C were raised by the quench from 1200 degrees Fahr."

Employ Oil, Sand and Litharge To Make Oil Sand Match

Q.—We have occasion to use an oil sand match and will appreciate information on the correct mixture of sand, oil and litharge.

A.—On a percentage basis the mixture for an oil sand match would contain approximately 94.5 per cent sand, 2.5 per cent oil, 2.00 per cent water and 1.00 per cent litharge. Since nice precision instruments usually are not found in the molder's bag of tools, and since considerable variation is permissible in the mixture, the following rough and ready method will produce satisfactory results: To one shovelful of sand add a cupful of linseed or other core oil, a small handful of litharge and enough water to give the sand the feel and temper of good molding sand.

The mixture is rammed much harder than sand in a mold. In fact it cannot be rammed too hard. After the joint has been made carefully and accurately and after the pattern has been rapped and removed, the match is placed in a warm, dry place for approximately 24 hours, when it may be given a light coat of shellac. In the event you are interested, several proprietary materials are available for making matches. Also some foundries prefer to use slightly moistened fire clay for the same purpose.

GANGWAY!

By J. A. Patterson

"Oh, I'll admit it's patriotic Benson, but after all—"

Solid Chill Cracks Ring Casting

Q.—We are having trouble with a cast iron ring 27 inches outside diameter, 3¼ x 4¼ inches in cross section, to be chilled as deeply as possible on the inside. Poured with comparatively soft iron the casting does not crack, but the chill is not deep enough. Poured with a harder iron to secure a deep chill, the casting invariably cracks. We have poured them hot and cold and have shaken them out while still red hot, but have not succeeded in finding a permanent remedy.

A.—Your are bucking one of the natural laws involving the contraction of metal when passing from the liquid state at a high temperature, to the solid state at atmospheric temperature. Solution of the problem in the present instance is to either cut your chill into a number of short pieces about 3 inches across the face, or cast a new set of short pieces. These are set in the mold ½-inch apart and green sand is rammed between them. They may be rammed up with the pattern, or set in the mold after the pattern is removed.

The first method is preferable since the space between the chills is filled during the process of ramming the drag. The chill blocks may be given a light coating of black wash and dried in the oven, or simply coated with oil and a light coating of plumbago brushed or rubbed on by hand. This sectional chill will function as satisfactorily as a complete one piece, or a chill in two or more pieces where the ends fit tightly together. The sand between the sections will allow for contraction of the casting and the composition of the iron in the casting may be hard enough to give any desired depth of chill in the ring casting.

Must Remove Oxygen From Copper Bath

Q.—We have been trying to salvage copper wire and cable that has been burned and have trouble with the castings swelling and raising up after pouring in iron chills. The cable is one inch in diameter and made up of fine wires braided together, and is badly burned and oxidized.

A.—Your description of the copper wire indicates that it was covered with rubber insulation previous to burning. Consequently, in addition to being badly oxidized, it also contains sulphur from the rubber. The mushrooming or raising up as you call it of the metal from the hold is due to the oxygen content, and that must be removed to obtain sound castings.

Our suggestion would be to sell the scrap copper wire, or exchange it for ingot copper. However, if you want to attempt to salvage the cable the following procedure will be of help. Start by melting down a good ingot or two to form a molten pool in the bottom of the crucible. Keep that covered well with fine charcoal, and then add small amounts of the scrap copper cable. The cable should be pushed down under the surface of the molten metal, and only enough added at a time which will dissolve without the whole mass becoming chilled. After each addition let the metal become good and hot again before adding more cold material.

Follow that procedure until the crucible is nearly full, and heat until the metal is hot and fluid. Then to the molten bath add about 1 pound of 10 per cent manganese-copper for each hundred pounds of metal in the crucible. The manganese will remove the sulphur and also deoxidize the copper. You may find that it may be necessary to double the amount of manganese-copper to get rid of all the sulphur which will combine with the manganese to form a scum which rises to the surface. The scum should be skimmed off before pouring. If you intend to use the copper to make brass or a bronze in which a small amount of zinc is permissible, it is suggested that you add say one-half to one per cent or a little more zinc just before pouring. Addition of zinc will aid in the oxidation, and insure production of a sound casting or ingot.

1944 WAR FUND

Kerosene To Clean Wood Coreboxes

Q.—Recently in your *Question and Answer* department you stated that metal coreboxes could be cleaned with a 2.00 per cent solution of potash in water. Nearly all our coreboxes are wood and we have a great deal of difficulty in keeping them clean. Our core mixture contains white silica sand, core oil and a small amount of cereal binder.

A.—Up to the present we are not familiar with any material that will keep coreboxes clean automatically and indefinitely. A certain amount of cooperation is needed on the part of the coremaker. If that enterprising individual could be persuaded to wipe the box occasionally with a kerosene soaked rag or handful of waste, the wooden boxes would remain clean. This is particularly true at the end of the day, or at any time the corebox is laid away for a short or long period.

Design Metal Molds For Aluminum

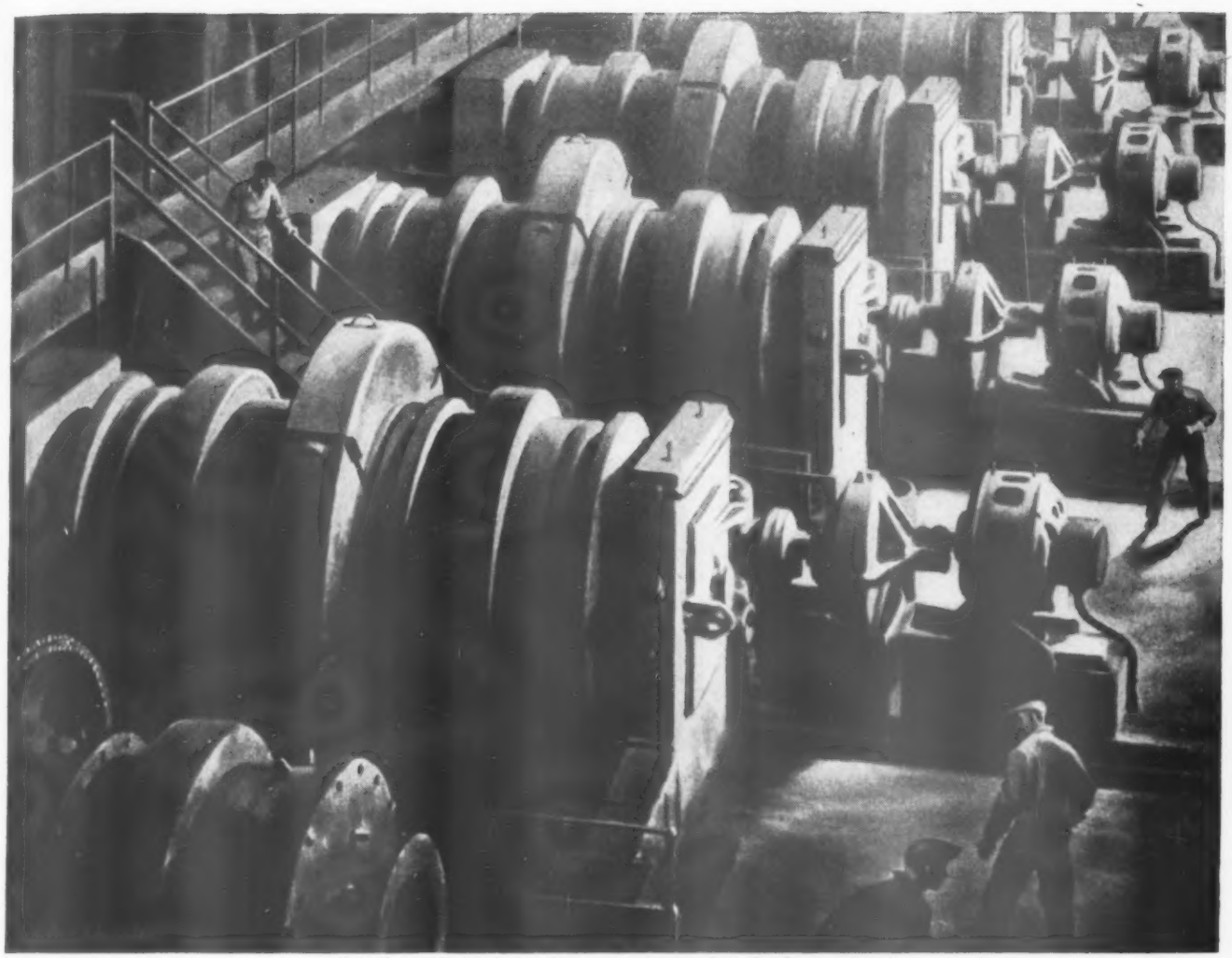
Q.—Do you have any information on design features of metal molds for production of aluminum castings?

A.—Not a great deal has been published on the design of molds, but the following general principles may be of interest. Usually the mold is about three times the thickness of the casting to be made, and the gate section in particular should be much heavier than would appear necessary; the extra thickness permitting changes without difficulty. Naturally, the mold design should produce sound castings, and allow the casting to be removed easily from the mold. Parting lines produce flash or fins, and should be located so as not to affect the casting appearance. The parting also acts as a vent, and location at corners permits sharp impressions.

Molds may be in two or more pieces depending on the form of the casting. Casting may be made in one part of the mold with the other part acting as a cover plate, or half of the cavity, gate and riser may be cut into each half of the mold. Again the mold may be in several sections which have to be assembled and reassembled each time. Separate parts of the mold must be doweled carefully to insure accurate location, and a simple but adequate locking arrangement must be provided.

Additional vents must be provided to obtain castings with sharp impressions, and those are made by cutting shallow grooves in the mold joints which extend almost to the casting cavity, say within 1/32-inch. The grooves may be 5/16-inch wide and 1/32 or 1/16-inch deep, or just a few thousandths of an inch deep formed with a half-round file. Location and number of vents will have to be determined by experiment.

Location of gates is a matter of experience, and may be through the light or heavy section of the casting. Essential point is to get the metal in without turbulence, and get even distribution to eliminate hot spots. Gates often are curved, and gating may be at the top or at the bottom. Tall objects usually are fed with narrow gates extending along the side from top to bottom. The gate should not be too large so that it and its junction remains molten for a long period after the casting has solidified. Variation in cooling rates for the mold or sections may be obtained by use of copper chill inserts which conduct heat more rapidly than cast iron, by use of pins on the back surface which increase the radiating area, making parts of the mold hollow so that water cooling may be employed. Conversely, coating the mold cavity with an insulator such as a mixture of whiting, water glass and graphite, or smoking with an acetylene flame will decrease the cooling rate.



Grinding mills used to reduce ore to appropriate size for treatment

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to KEEP 'EM PRODUCING!

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And it's modern mining machinery that speeds 'em on their first step to Berlin and Tokio.

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THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

Considers Problem Of Metal Wear

Q.—We make machine tool castings, and have found by experience that best results on wearing surfaces are obtained with a brinell of 150 to 180, and when it exceeds 200 we are likely to have galling and seizing in steel against the iron. In some cases we have taken castings with brinell over 200 and annealed at 1300 degrees with furnace cooling; reducing hardness 40 to 60 numbers. Scraping tests on 215 brinell iron, and that annealed to give 155 indicate that the latter, while softer, shows a greater tendency to scratch.

A.—So many factors enter into a consideration of the problem of wear that it is difficult to discuss the subject without knowledge of the condition of service, type and finish of the steel mating parts, pressures, clearances, lubrication, etc., and those of course, determine the most suitable structure for lowest wear. Your remarks on hardness indicate that an iron with a brinell from 150 to 180 gives the most satisfactory service in your castings, and such iron as cast is likely to be fairly open grain with relatively large graphite flakes. The ferrite present usually is well distributed rather than in patches. In general the surface of iron holds lubricants well, and the coarse graphite aids in that connection, particularly at low bearing pressures.

With higher brinell hardness such as over 200, the metal is finer grained, and if the structure is uniform with good finish on both iron and steel parts, good wear resistance will be obtained. Unfortunately, some of the higher brinell irons develop a structure containing patches of fine graphite enmeshed in ferrite which do not hold lubricant well, and are likely sources of galling and seizing. With reference to heat treatment to reduce brinell hardness, we believe that your procedure of decreasing it 60 points as mentioned may cause trouble. Reduction of brinell from 200 to 140 results in a large amount of ferrite being formed in the structure without increasing grain and graphite flake size correspondingly. Hence lubrication, whether applied or inherent, is not as good as in cast iron originally to that hardness. Such iron will scratch more than an iron initially soft or hard. For non-lubricated contact and heavy pressure, harder iron of uniform structure is more resistant to galling.

Fire Clay Is Used For Followboard

Q.—Some years ago we read an article in THE FOUNDRY describing clay followboards. At the time we were not interested and therefore my recollection of the details is rather vague.

A.—The article to which you refer "Fire Clay for Followboards" was presented in the June, 1933, issue of THE FOUNDRY. Unfortunately no copies of that issue are available, but the following brief description may serve your present purpose: Clay is used extensively for followboards, particularly where a considerable number of small irregular shaped patterns are attached to a gate. A wood frame 2 or 3 inches deep, depending of course on the depth of the patterns, and corresponding in inside dimensions to the flask to be used later, is nailed to a bottom board. The frame is soaked in or painted with linseed oil as a preservative against swelling, warping or shrinking.

Fire clay moistened with water and a little oil is packed in the frame and scraped off flush with the upper edge. Suitable depressions are scooped in the face and the patterns are rapped down the required distance for a parting line. The molder then uses small tools to shape the clay up or down to follow the parting line around each pattern. The patterns may have to be lifted out once or twice to make sure the parting line is correct. The patterns then are rapped lightly, and if necessary the followboard may be used immediately. Some of these boards have been in use for years. Others may be used only a short time. Then the clay either is knocked out to make place for a new batch, or it may be moistened with water and reworked to accommodate a new set of patterns. These followboards are used on the bench, or on hand or power squeezer machines.

Nonskid Plates for Charging Floor

Q.—We would like to install cast iron plates on the floor of our nonferrous melting room. Brick and concrete have not been satisfactory. We shall appreciate any information on the method of making nonskid or nonslip iron plates somewhat similar to stair treads which have emery or some other material bedded in the metal surface. We shall cast them in our gray iron foundry.

A.—Abrasive materials, carbide of silicon, alumina, etc., used in the production of nonskid surfaces on castings may be held in place on the mold surface by any one of several materials including thin claywash, molasses water and sodium silicate (water glass). The liquid is sprayed on the mold face and the abrasive material is sprinkled through a sieve or screen of the proper mesh size. The first thin coat is sprayed again and covered with a second application of the abrasive. The face of the mold then is skin dried with a torch or in any other suitable manner. Although the process is apparently simple, a considerable amount of experience is required to secure satisfactory results.

Either one of two other types of plates can be made more easily and may serve your purpose. The first is plain, or ribbed on the back and has diamond shaped shallow indentations on the face or working surface. Wood for the pattern, with grooves already cut may be ordered from foundry, or pattern supply houses. For the second type plate the pattern is plain on both sides. After the pattern is removed from the mold, small pieces of 1-inch stock core, or small pieces of broken cores are set indiscriminately in the drag. The only requisite is that these pieces shall be thick enough to touch the cope, to prevent them from floating away when the mold is filled with molten iron. The cores are left in place when the plate is laid down on the floor and provide a definite nonskid surface. In a third type of flooring, cast iron gratings are bedded in concrete flush with the top surface. It is claimed that this floor is comparatively cheap, easy to install and highly resistant to traffic. The grating sections may be cast to any desired size or shape. In a typical example each section is 18 x 30 inches, ¾-inch thick, with 1-inch square openings separated by ½-inch strips. Each casting weighs 47 pounds.

Wants Information On Beryllium Alloy

Q.—We have some beryllium-copper containing 2.5 per cent beryllium and 1 per cent nickel which we would like to cast into plates ½-inch thick and 10 inches square. Can you give us any information on difficulties which we might encounter in melting and pouring the alloy? Will it be advisable to add more copper and reduce the beryllium content to 1 or 1.25 per cent? How much beryllium is lost in melting? What can be expected in physical properties in the various instances?

A.—Beryllium-copper castings may be produced in chill, plaster, dry sand and green sand molds, and the choice of method will depend upon the size and intricacy of the casting. Heading and gating is similar to that employed with phosphor-bronze castings. Melting should be under a cover of charcoal to hold oxidation losses to a minimum. Pouring temperature is around 2000 to 2100 degrees Fahr. Stirring and skimming should be performed with graphite tools since any addition of iron to the alloy is detrimental.

Beryllium-copper can be heat treated to obtain a wide range of physical properties, and of course, those also will depend upon the beryllium content. Consequently, you will have to decide what to shoot at in the way of physical properties, and change the beryllium content, and heat treatment accordingly. Roughly, it might be said that an alloy containing 2.5 per cent beryllium will have a tensile strength of 70,000 pounds per square inch or better, and elongation of 10 per cent, and a brinell hardness of 158 in the as-cast state; after annealing the tensile will decrease, elongation will increase, and hardness will decrease; heating the alloy to 1475 to 1500 degrees Fahr., quenching in water, and drawing at 575 degrees Fahr. for 3 hours will increase the tensile strength to over 100,000 pounds per square inch, decrease the elongation to practically zero, and increase the brinell hardness to around 400 or better. With lower beryllium content, the various physical properties referred to naturally would be somewhat lower also.

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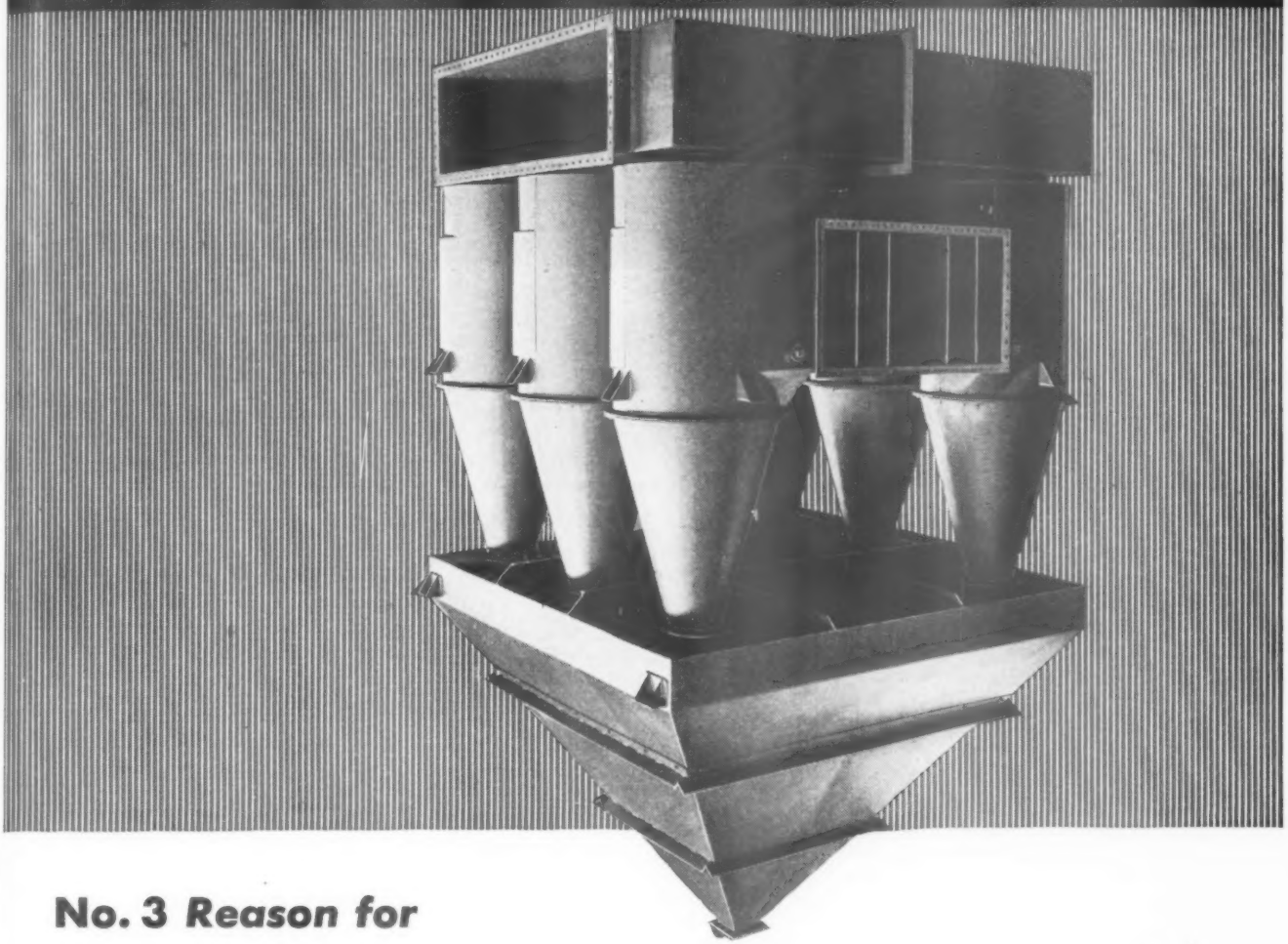

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This extra-sturdy construction is possible only with large-diameter cyclones and is one of the plus values that have made Buell Dust Recovery Systems famous throughout industry for long life and low maintenance.

How the patented "shave-off" of the van Tongeren cyclone (found only in Buell Dust Recovery Systems) makes it possible to use large diameters and, at the same time, obtain high collection efficiencies is fully described in a 28-page book: "The van Tongeren System of Industrial Dust Recovery." To secure a copy, simply write us for Bulletin G-842.

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DUST RECOVERY SYSTEMS

BUELL FEATURES	RESULT IN	PRODUCE
SHAVE-OFF LARGE DIAMETERS	HIGH COLLECTION EFFICIENCY	GREATER RECOVERY
EXTRA-THICK METAL	LESS FAN BLADE WEAR	LOW MAINTENANCE
LARGE OUTLETS	LOW DRAFT LOSS	LOW OPERATING COST
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CORRECTLY DESIGNED HOPPERS	HIGH TEMPERATURE RESISTANCE	NO CLOGGING
SPLIT-DUCT MANIFOLDS	UNLIMITED CAPACITY	
	NO MOVING PARTS	
	FREE DUST FLOW	

DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

MEN ...of Industry

FRANK E. BATES, chairman of the Western New York Chapter of the American Foundrymen's Association, also is chairman of the general committee in charge of local arrangements for the A.F.A. Foundry Congress to be held in Buffalo, April 25-28. At present associated with Worthington Pump & Machinery Corp. as melting supervisor of the Buffalo Works, Mr. Bates at one time was assistant general foreman of coke ovens at Bethlehem Steel Co.'s Lackawanna plant. Later connections included melting supervisor of American Brass Co. at Detroit, and the marketing division of Socony-Vacuum Corp. Mr. Bates served with the 27th Division of the A.E.F. in the last war.

♦ ♦ ♦

John Vickers, foundry manager, Rolls Royce Co. Ltd., England, is the author of the Institute of British Foundrymen exchange paper to be presented before the A.F.A. War Production Foundry Congress next month in Buffalo. Mr. Vickers' paper, entitled "The Mechanized Production of Gravity Die Castings", will be presented before one of the sessions of the Aluminum and Magnesium Division. Mr. Vickers was born in Darlington, County Durham, England. Graduated from Darlington Technical College, he served a 5-year apprenticeship with Robert Stevenson & Co. Ltd., Darlington, and later worked as a journeyman patternmaker with R. D. Crosthwaite & Co. Ltd., Thornaby on Tees. He joined Rolls Royce Ltd. in 1932 as a patternmaker, was made superintendent of the iron foundry in 1937. In 1939 was appointed foundry manager of another Rolls Royce foundry producing aircraft castings.

♦ ♦ ♦

J. P. Lawrence, formerly vice president and general manager of the American MonoRail Co., Cleveland, has been made president following the retirement of **H. M. Miller,** who is now chairman of the board. Other officers are **F. C. Harris,** vice president and chief engineer; **C. deV. Miller,** vice president and sales manager; **J. L. Pischke,** secretary and treasurer.

♦ ♦ ♦

Herschel J. Wood has been appointed southwestern representative of the Lebanon Steel Foundry, Lebanon, Pa., and will be in charge of that firm's new office at 1505 Commerce building, Houston, Texas. Mr. Wood was formerly associated with the Elastic Stop Nut Corp. of America.

♦ ♦ ♦

Ed H. McKinley, owner of the McKinley Iron Works, Fort Worth, Tex., and a veteran of 51-years' experience in the foundry industry, has retired to his 60-acre farm near Birdsville, Tex. Operation of the company will be carried on by members of the McKinley family under the general management of a son, **DeWitt McKinley.** Mr. McKinley was born in Tyler, Tex., in 1874, and left the farm home of his parents when he was 18 to start work in a foundry. He moved to Fort Worth in 1903, and in 1906 in partnership with W. P. Bowdry he formed the Bowdry & McKinley Iron Works to produce gray iron castings. The partnership was dissolved in 1933.

♦ ♦ ♦

Ernest R. Starkweather has joined the research staff of the Carborundum Co., Niagara Falls, N. Y., as a metallurgist. Recently he had been associated with the Lufkin Foundry & Machine Co., Lufkin, Tex., in a similar capacity. Mr. Starkweather was graduated from Sheffield Scientific School, Yale University, and has been engaged in metallurgical work for a number of years. His industrial connections have included the Winchester Repeating Arms Co., New Haven, Conn.; Colt Fire Arms Co., Hartford, Conn.; Farrel-Birmingham Co., Ansonia, Conn.; Worthington Pump & Machinery Corp., Buffalo, and Titanium Alloy Mfg. Co., Niagara Falls, N. Y. Prior to joining the Lufkin Foundry & Machine Co. he engaged in metallurgical inspection work for the United States Navy. Mr. Starkweather is the author of several

(*Continued on page* 124)

JOHN VICKERS

HERSCHEL J. WOOD

FRANK E. BATES

J. P. LAWRENCE

Pioneers
In Air Conditioning

WOODWARD was the first merchant iron producer in America to apply the principle of air conditioning to furnace operations for the purpose of reducing moisture in the air blast.

No development in the iron industry in modern times has contributed so much to the control of uniformity in pig iron manufacture. This major advance, which Woodward pioneered and proved, has been so successful that it has since been followed widely by other iron producers.

This, and other modern methods which Woodward has adopted to improve constantly the quality of its iron output, combined with properties inherent in Woodward's raw materials, account for Woodward's growth from a small enterprise to the position it now holds as America's largest completely integrated independent merchant iron producer.

WOODWARD IRON COMPANY

Woodward, Alabama

Independent Since 1883

(*Continued from page* 122)

papers presented before conventions of the American Foundrymen's Association.

♦ ♦ ♦

Edward C. Smith has been elected president of the Bay City Electric Steel Casting Co., Bay City, Mich., succeeding Edward M. Mills, who has relinquished ownership of the company because of ill health. Other newly-elected officers are: **William L. Mueller,** vice president, and **C. C. Keegan,** secretary-treasurer. Mr. Keegan also assumes the duties of general manager.

♦ ♦ ♦

George E. Westerholm has been appointed abrasive engineer for the Norton Co., Worcester, Mass., in the Milwaukee territory where he will assist F. W. Grant. Mr. Westerholm has been with the Norton Co. for 21 years, formerly in the research laboratories and more recently as field engineer serving steel mills and foundries.

♦ ♦ ♦

Albert W. Hendrickson has been appointed director of employe services of Farrel-Birmingham Co. Inc., Ansonia, Conn. A graduate of the University of Pennsylvania, Mr. Hendrickson recently was director of industrial relations of the Kellett Aircraft Corp., Philadelphia.

♦ ♦ ♦

E. P. Buchanan, who has been working with iron consumers in the Pig Iron Section of the Steel Division, War Production Board, has returned to his post with Pittsburgh Coke & Iron Co., Pittsburgh.

♦ ♦ ♦

John L. Blair has resigned as steel foundry superintendent of the Roxbury Steel Casting Co., Roxbury, Mass., to become steel foundry manager of the Dedman Foundry & Machine Co., Houston, Tex. A native of Glasgow, Scotland, where he served his apprenticeship, Mr. Blair at one time was foreman with the Union Steel Casting Co., Boston. Later he became steel foundry superintendent of the former Industrial Works, Bay City, Mich. Subsequent

JOHN L. BLAIR

connections included the Hartford Electric Steel Corp., Hartford, Conn., and the Dedman Foundry & Machine Co., to which latter company he is returning.

♦ ♦ ♦

R. J. Roshirt, Bohn Aluminum & Brass Corp., Detroit, and **C. A. Brantingham,** Ebaloy Foundries Inc., Rockford, Ill., have been appointed to the Nonferrous Foundry Industry Advisory Committee of the Office of Price Administration.

♦ ♦ ♦

William O. Wilson has been appointed commercial vice president of Worthington Pump & Machinery Corp., with supervision over the Chicago, St. Louis, Kansas City and St. Paul district office territories and with headquarters in the Chicago district office. Associated with the Worthington and predecessor companies for more than 40 years Mr. Wilson since 1937 had been manager of the company's midwest district.

♦ ♦ ♦

Bernard Dunne has rejoined the Western Metal Co., Chicago, as chief metallurgist, following a leave of absence of several months. Graduated from the Colorado School of Mines in 1937, Mr. Dunne obtained a wide and varied experience in the nonferrous smelting, refining and casting business before becoming associated originally with the Western Metal Co. as mill superintendent.

♦ ♦ ♦

Albert W. Gray recently was elected president of the Hartford Electric Steel Corp., Hartford, Conn., and its wholly owned subsidiary, the Roxbury Steel Casting Co., Boston, succeeding the late Theodore W. Monroe. Mr. Gray has been associated with the Hartford company since its organization in 1927, and served during that period as chairman of its board of directors.

♦ ♦ ♦

Edward W. Campion, recently president of the Bonney-Floyd Co., Columbus, O., has been elected chairman of the board. He has been succeeded as president and general manager by **Raymond E. Fisher,** previously vice president.

♦ ♦ ♦

C. A. Gehrman has been appointed assistant sales manager of the Sterling Wheelbarrow Co., Milwaukee. He had been sales engineer for the company since 1928, and recently had been assistant to R. F. Jordan, sales manager.

♦ ♦ ♦

H. N. Arbuthnot has been named regional manager in Detroit for Allegheny

(*Concluded on page* 126)

REX J. MYERS

Appointed in charge of foundry machinery design and maintenance, Ferro Machine & Foundry Co., Cleveland, as reported in THE FOUNDRY for February

ARTHUR TUMPACH

Appointed metallurgist in charge of all melting operations, Ferro Machine & Foundry Co., Cleveland, as reported in THE FOUNDRY for February

FRANK WEISEHAN

Appointed superintendent of foundry, core room and mill room, Ferro Machine & Foundry Co., Cleveland, as reported in THE FOUNDRY for February.

The Editors regret that through a mechanical error, this page was printed with the captions on the illustrations of Mr. Myers and Mr. Tumpach interchanged. Mr. Tumpach, in charge of melting operations, is shown above at the left and Mr. Myers, in charge of design and maintenance, is shown in the center above.

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Ask the Men Who Use It!

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What's the sense of taking chances when you can have the scientific, uniform accuracy of DAYTON Core Oils? Get these DEPENDABLE Oils for utmost accuracy in your vital wartime production. Be assured of a bare minimum of waste! Dayton Core Oils are doing their part in foundries producing the implements of war. Let the trained Dayton Oil service man give you the benefit of his long experience.

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STEEL CORE AND MOLD WASHES • BINDER AND CORE PASTE • CORE WASHES • CHILL COATINGS

(*Concluded from page* 124)

Ludlum Steel Corp., Brackenridge, Pa. Mr. Arbuthnot formerly was assistant sales manager. In his new capacity he will consolidate direction of the corporation's manufacturing unit in the Detroit area, the Forging and Casting Division, and the Detroit sales branch.

♦ ♦ ♦

Charles E. MacQuigg, dean of engineering at Ohio State University, Columbus, O., was presented the James Turner Morehead Medal of the International Acetylene Association at a dinner

CHARLES E. MacQUIGG

in his honor Jan. 24 in New York, for "advancing the oxy-acetylene process through metallurgical research, and for leadership in welding engineering education."

♦ ♦ ♦

Daniel W. Talbott, formerly plant superintendent of the recently closed South Plant of Ohio Steel Foundry Co., Lima, Ohio, has become plant superintendent for C Plant of Symington-Gould Corp., Rochester, N. Y.

♦ ♦ ♦

Henry Barnett has resigned as director of research for Electric Steels Ltd., Cap de la Madeleine, Quebec, to become works manager of Welland Electric Steel Foundry Ltd., Welland, Ont.

♦ ♦ ♦

Lawrence J. White has been appointed Chicago sales representative for centrifugal bronze castings by Shenango-Penn Mold Co., Dover, O.

♦ ♦ ♦

D. S. Grewar recently was made foundry superintendent, Walworth Co., Washington Park, Ill. After graduation from school, Mr. Grewar served a 4-year apprenticeship in the plant of M. Beatty & Sons, Welland, Ontario. He then served for 2½ years with the Canadian Armed Forces during the first World War. After his return he worked for a time in the Longue Pointe plant of the Canadian Steel Foundries, Montreal, and later with the Dominion Steel Foundries Ltd., Hamilton, Ont. In 1924-25 he was employed by the Reading Steel Casting Co., Reading, Pa., and for the following 2 years was connected with the Erie Forge & Steel Co., Erie, Pa. For the past 16 years he served as foundry foreman and later as superintendent of foundries of the Standard Stoker Co., Erie, Pa.

SAE Forms Panel On Castings

The Society of Automotive Engineers recently organized a number of panels to deal with special problems in particular fields of industry. Panel II on iron and steel castings has the following personnel: Fred J. Walls, International Nickel Co., Detroit, chairman; V. A. Crosby, Climax Molybdenum Co., Detroit, vice chairman; H. S. Austin, Buick Motor Division, General Motors Corp., Flint, Mich.; A. L. Boegehold, Research Laboratory, General Motors Corp., Detroit; A. W. Demmler, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.; C. K. Donoho, American Cast Iron Pipe Co., Birmingham; Carl Joseph, Saginaw Malleable Iron Co., Saginaw, Mich.; A. B. Kinzel, Electro-Metallurgical Corp., New York; Harvey Lepke, Chrysler Corp., Detroit; R. G. McElwee, Vanadium Corp. of America, Detroit; F. A. Melmoth, Detroit Steel Castings Co., Detroit; Garnet Phillips, International Harvester Co., Chicago; Gus Vennerholm, Ford Motor Co., Dearborn, Mich.

Officers Elected by Steel Founders

Oliver E. Mount, American Steel Foundries, Chicago, has been re-elected president of the Steel Founders' Society of America for 1944-45. Other officers include: Vice president, F. Kermit Donaldson, Machined Steel Casting Co., Alliance, O.; executive vice president, Col. Merrill G. Baker, Steel Founders' Society of America, Cleveland; secretary-treasurer, Raymond L. Collier, Steel Founders' Society of America, Cleveland.

Members elected to the executive committee are: Mr. Mount; A. M. Andorn, Penn Steel Casting Co., Chester, Pa., and T. F. Dorsey, Fort Pitt Steel Casting Co., McKeesport, Pa.

Named to the board of directors are: Mr. Andorn; D. P. Murphy, Symington-Gould Corp., Depew, N. Y.; J. S. Wardle, Mobile Pulley & Machine Works, Mobile, Ala.; T. F. Dorsey, Fort Pitt Steel Casting Co., McKeesport, Pa.; Mr. Donaldson; E. D. Flintermann, Michigan Steel Casting Co., Detroit; C. A. Binder, St. Louis Steel Casting Co., St. Louis, and W. E. Butts, General Metals Corp., Oakland, Calif.

Officers, Directors Nominated by A.F.A.

Ralph J. Teetor, president, Cadillac Malleable Iron Co., Cadillac, Mich., was nominated to succeed L. C. Wilson, general manager, Reading Steel Casting Division, American Chain & Cable Co., Reading, Pa., as president of the American Foundrymen's Association, at a meeting of the nominating committee of the A.F.A. held in Chicago, Jan. 11. At the same time, Fred J. Walls, International Nickel Co. Inc., Detroit, was nominated for the vice presidency. Both offices are one-year terms.

The following were nominated to become directors of the association for three-year terms: Frank J. Dost, Sterling Foundry Co., Wellington, O.; S. D. Russell, Phoenix Iron Works, Oakland, Calif.; Ralph T. Rycroft, president, Jewell Alloy & Malleable Co. Inc., Buffalo; Joseph Sully, president, Sully Brass Fdry. Ltd., Toronto, Ont.; and Lee C. Wilson.

Election of officers and directors will be held at the annual business meeting of the association, which will take place during the third War Production Foundry Congress at Buffalo, April 25-28.

All nominees have been active in work of chapters of the A.F.A., Mr. Teetor served as a director of the Western Michigan Chapter; Mr. Walls is a past director of the Detroit Chapter; Mr. Dost is a past chairman of the Northeastern Ohio Chapter; Mr. Russell is a past chairman of the Northern California Chapter; Mr. Rycroft is a past chairman of the Western New York Chapter, and Mr. Sully is a past chairman of the Toronto Chapter.

Members of the 1944 A.F.A. nominating committee are as follows: Past President L. N. Shannon, Stockham Pipe Fittings Co., Birmingham, Ala.; Past President D. P. Forbes, Gunite Foundries Corp., Rockford, Ill.; Past President H. S. Simpson, National Engineering Co., Chicago; L. C. Farquhar, American Steel Foundries, East St. Louis, Ill.; J. H. Lansing, Malleable Founders' Society, Cleveland; William Romanoff, H. Kramer & Co., Chicago, and F. G. Sefing, International Nickel Co. Inc., New York.

Offers Hygiene Code For Foundries

A new "Code of Recommended Practices of Industrial Housekeeping and Sanitation," is being offered by the American Foundrymen's Association, 222 West Adams Street, Chicago, at $1 to members and $1.50 to non-members. This code, prepared by the association's Industrial Hygiene Codes Committee, is No. 7 in the series developed for fostering foundry safety and hygiene. It gives necessary engineering data and minimum requirements for industrial housekeeping and sanitation and may be adapted to meet requirements of any size plant.

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That's mighty important today!

Because the sailing of a ship, for example, might be held up because a contractor had to wait for a casting like the one in the illustration. With Truline, foundry men find jobs run smooth—and faster. First, you save time in making the cores themselves. Then you save in baking and clean-up.

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● For that reason, be sure you get the *one right bonding clay*. There's only one for every job. ECP offers you a choice of five products, each with its own characteristics, together with many "in-between" combinations:

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ECP *All* TYPES OF BONDING CLAYS

A Foundry Sand Service Based Upon Practical Research

STEEL FOUNDERS
Face Sustained War Demands

THEODORE H. HARVEY

Recipient of the Lorenz Medal from the Steel Founders' Society of America for outstanding contribution to advancement of the steel foundry industry

ALTHOUGH the steel foundry industry has done a remarkable war production job in expanding its output of castings to more than 2,700,000 tons in 1943 and in developing improved products for war purposes, the continued heavy requirements of the armed forces and essential civilian needs will permit no relaxation in the industry's efforts for some time to come.

This prospect was indicated at the forty-second annual meeting of Steel Founders' Society of America held at the Edgewater Beach Hotel, Chicago, Feb. 9-10. Registration of more than 350 representatives of member companies marked the largest attendance ever recorded at the organization's annual gatherings.

Encouraging progress in technical development work, despite the shortages in plant facility and manpower resulting from the war, was reported by Charles W. Briggs, technical and research director of the society. Work has started on six projects proposed by the technical research committee and approved by the board of directors. These include: 1. Determination of mechanical properties of the low-alloy (NE) steels as produced for castings. 2. Determination of critical dimensions of necked-down risers. 3. Comparison of the properties of core oils and binders, and the development of acceptance tests. 4. Determination of the relation of impact strength to hardness and ductility in cast steels. 5. Investigation of the value of low-temperature ceramic glazes as mold washes. 6. The preparation of "S" or time-temperature transformation curves for use in the heat treatment of cast steel.

Mr. Briggs also reported that the society was undertaking a study of all A.S.T.M. specifications relating to steel castings, for the purpose of making available to buyers more useful information on the properties and adaptability of cast steel products.

The technical session of the two-day meeting consisted of a symposium on "Water Quenching of Steel Castings," and included six papers. Lee C. Wilson, Reading Steel Casting Division of American Chain & Cable Co., Reading, Pa., was panel chairman. Mr. Briggs introduced the subject with a review of the 35-year history of water quenching as practiced by steel foundries, tracing the developments since 1908 when the Taylor-Wharton Iron & Steel Co. first water quenched cast steel gold dredge buckets. However, interest in the practice was light for a number of years, and the tonnage of quenched and tempered castings sold during the 1920's was relatively small. More attention was paid to the subject thereafter, accompanied by the introduction of specifications giving requirements for quenching. As pointed out by Mr. Briggs, certain restrictions have remained imposed on use of quenching. Navy specifications today, for instance, do not allow quenching unless specifically permitted. Nevertheless, the production of liquid quenched steel castings within the past three years has grown to a sizable tonnage, the speaker estimating 1943 output as at least 250,000 tons. With buyers becoming more experienced with the results of this type of treatment, Mr. Briggs predicted a further increase after the war in the proportion of castings so treated. He stated that it is not unlikely that within the next 10 years, 50 per cent of all alloy steel castings will be liquid quenched and tempered.

In a paper on "Requirements for the Water Quenching of Small Steel Castings," J. W. Juppenlatz, Lebanon Steel Foundry, Lebanon, Pa., listed various factors which should be considered in the production of water-quenched castings. Sound metallurgy is a natural requisite. Care in arranging castings in the heating furnace so as to permit uniform heat circulation also is important. The time factor must be watched, not only in removing castings from the furnace preparatory to quenching and in tempering after quenching, but also in avoiding over- or under-quenching by an incorrect immersion period in the bath. Creation of steam pockets during quenching should be avoided. Mr. Juppenlatz showed slides of characteristic cooling rate curves, and emphasized that quenching must be carried out with a known rate of cooling.

Problems encountered in the water quenching of miscellaneous sized steel castings were discussed by W. B. Libert, Continental Roll & Steel Foundry Co., East Chicago, Ind. He pointed out that warpage may occur in heating castings of complicated shape, and that adequate blocking is necessary to avoid this difficulty. Flexibility in heating control also is advisable in order to overcome non-uniform loading of castings in the furnace. Uniformity in quenching will depend to a certain extent on the arrangement of the castings, particularly in batch immersion where the danger exists of creating steam pockets because of lack of free circulation of the water. Like the other speakers Mr. Libert stressed the importance of speed in unloading castings from the furnace. Slides were presented to illustrate the type of equipment employed in heating and quenching of castings generally weighing up to 18,000 pounds.

Practice in the water quenching of large steel castings was described by R. A. Gezelius, General Steel Castings Corp., Eddystone, Pa. Among various factors to be considered, he mentioned the temperature of the castings as quenched, amount of water in the bath, time of quenching, and temperature and time of subsequent tempering. Mr. Gezelius showed slides of a continuous handling system for heating and quenching castings. This system employs automatic timing of immersion and removal of the castings from the bath.

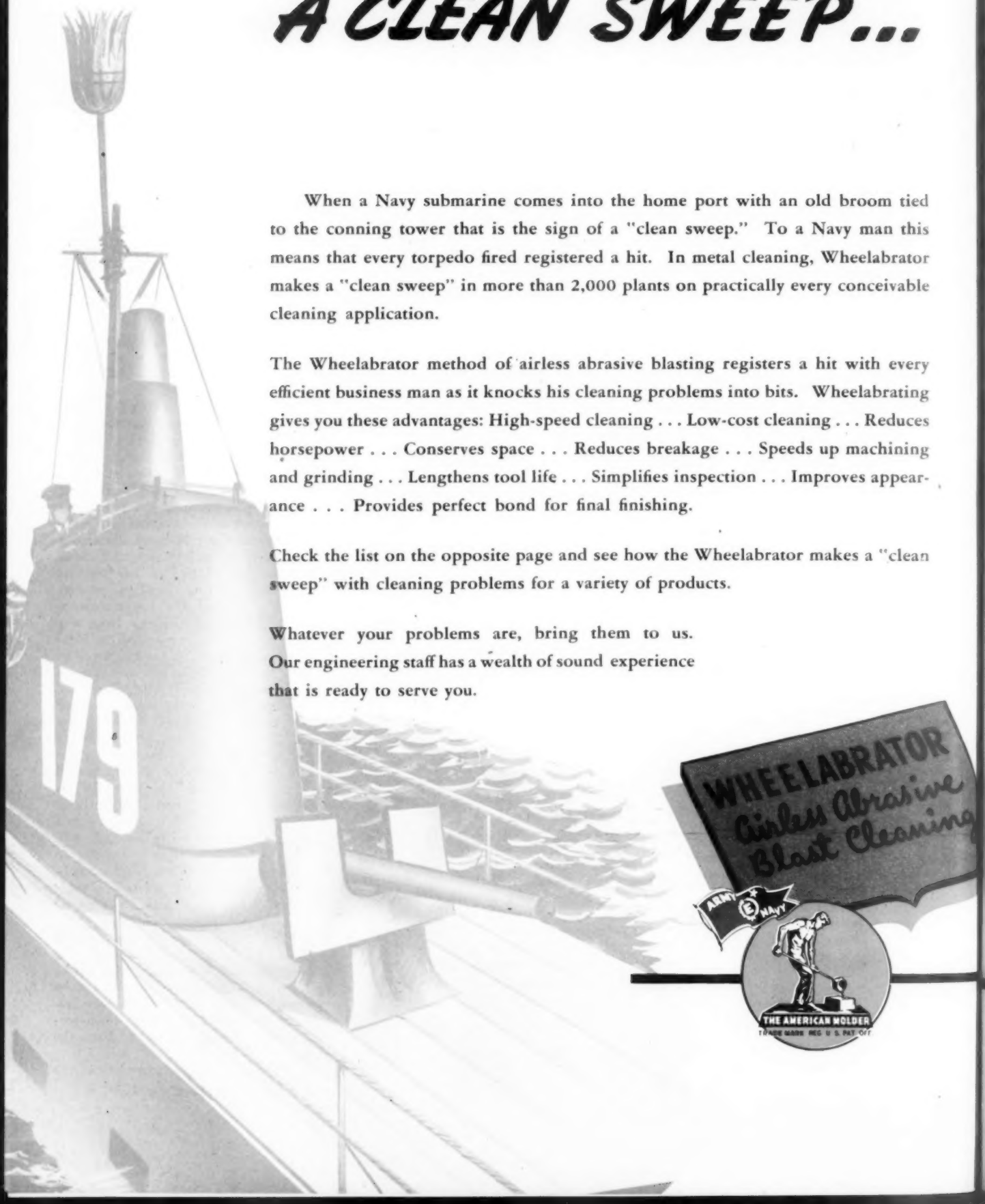
In quenching heavier castings having sections of varying thicknesses, the speaker stated it is desirable that care be exercised in order that there will not be too much variation between the temperatures of the heavier and the thinner sections before they are removed from the bath.

Importance of design and mass in the

(*Continued on page* 132)

By WILLIAM G. GUDE
Associate Editor
THE FOUNDRY

A CLEAN SWEEP...



When a Navy submarine comes into the home port with an old broom tied to the conning tower that is the sign of a "clean sweep." To a Navy man this means that every torpedo fired registered a hit. In metal cleaning, Wheelabrator makes a "clean sweep" in more than 2,000 plants on practically every conceivable cleaning application.

The Wheelabrator method of airless abrasive blasting registers a hit with every efficient business man as it knocks his cleaning problems into bits. Wheelabrating gives you these advantages: High-speed cleaning . . . Low-cost cleaning . . . Reduces horsepower . . . Conserves space . . . Reduces breakage . . . Speeds up machining and grinding . . . Lengthens tool life . . . Simplifies inspection . . . Improves appearance . . . Provides perfect bond for final finishing.

Check the list on the opposite page and see how the Wheelabrator makes a "clean sweep" with cleaning problems for a variety of products.

Whatever your problems are, bring them to us. Our engineering staff has a wealth of sound experience that is ready to serve you.

Wheelabrator Scores on all these Applications

Cylinder blocks	Sporting equipment	Woodworking mach'y
Crankcases	Pumps	Gas engines
Tank turrets	Steam engines	Paper making mach'y
Gun castings	Conveying equipment	Valve tappets
Gear cases	Agricultural machinery	Oil burner parts
Tractor shoes	Cash registers	Steam shovels
Sprockets	Gas engines	Compressors
Valves (all kinds)	Oil well castings	Pipe fittings
Gear blanks	Motors and generators	Bushings
Manifolds	Machine tools	Sheave blanks
Sanitary ware	Lighting fixtures	Pistons
Railroad car wheels	Meter castings	Wheels
Textile machinery	Lawnmowers	Magnets
Stoker parts	Tractor parts	Stoves and furnaces
Carburetors	Airplane parts	Diesel engines
Cylinder sleeves	Railroad specialties	Fan pulleys
Chucks	Lamp bases	Bearings
Journal bearings	Cylinder barrels	Valve rocker arms
Ice machinery	Scales	Piston rings
Pillow blocks	Plumbing supplies	Hubs
Transmission mach'y	Hardware	Zinc die castings
Shoes lasts	Cast pipe	Universal joint yokes
Brake drums	Railroad signal parts	Sewing machines

NOTE: This is only a Partial List of many hundreds of casting cleaning applications

American

FOUNDRY EQUIPMENT CO.

505 S. BYRKIT ST. MISHAWAKA, IND.

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

(*Continued from page* 129)

water quenching of steel castings was stressed in a paper by W. J. Phillips, Symington-Gould Corp., New York. He pointed out that since it is not advisable to quench different section castings the same length of time, segregation of castings according to section size, is required for batch quenching. Casting design, not its actual mass, may cause trouble in quenching, he said, and offered the following recommendation for avoiding difficulties caused by improper design: Provide uniform thickness where possible; avoid abrupt changes in section thickness, and eliminate sharp corners. Cracking during quenching is most likely to occur if the casting temperature while in the water is dropped below 250 degrees Fahr. The speaker added that light sections of a casting should be reduced to 250 degrees before heavier sections reach 400 degrees. Charts of cooling rates for sections of various thicknesses were presented.

Many Factors Involved

In the concluding paper, "Equipment and Requirements for the Water Quenching of Steel Castings," R. H. Swartz, Ordnance Steel Foundry Co., Bettendorf, Iowa, explained that previous limitations on liquid quenching of ordnance castings have been replaced by specifications which call for certain physical properties without designating definite processing procedures. In describing the manner in which heating and quenching of various types of castings is handled by this company, Mr. Swartz stressed the importance of knowing the cooling rate of castings. Among a number of factors influencing the process, he mentioned the size and shape of the casting, temperature of the water, temperature of the casting when quenched, and surface per unit of volume.

A continuous system of heating and quenching is ideal under certain conditions, particularly in the case of large runs of like castings, he stated, although a reliable material handling system must be used. Mr. Swartz touched briefly on the flame heating-quenching treatment for processing individual areas or sections of a casting, and urged foundrymen to study the practice because of the likelihood of its increasing use in the future.

In subsequent discussion the question was raised as to the method of determining the temperature of a casting after it is in the quenching tank for a certain period. It was explained that while it is not common practice to take such temperature readings by instrument, a figure can be estimated from time-temperature charts which indicate the cooling rates for pieces of different thicknesses.

Reports by various officers of the society were presented at the opening session Wednesday morning at which Oliver E. Mount, American Steel Foundries, Chicago, and recently re-elected president of Steel Founders' Society of America, presided. Raymond L. Collier, secretary and treasurer, presented a financial summary and indicated a number of activities in which the society will be engaged in the current year. Col. Merrill G. Baker, executive vice president, in presenting his annual report of the activities of the society during the past year announced that the membership had reached the highest level in history both in point of number and in foundry capacity. He outlined some of the work carried on by the organization in co-operation with WPB, OPA and WMC.

Chauncey Belknap, general counsel of the society, discussed the recent attempt of the War Labor Board to involve steel foundries in a consideration of a uniform procedure to be followed in settling wage contract negotiations of basic steel companies with the USA-CIO union. Steel foundries have contended that they comprise a separate and distinct industry and should not be grouped with the basic steel industry in a union contract settlement.

Thornton Lewis, chief, Public Service Branch, Re-Adjustment Division, Army Service Forces, Washington, spoke on "Termination of War Contracts" and explained that additional adjustments in the termination procedure are in prospect which are expected to minimize what disruption will result from wholesale termination of contracts at the war's conclusion. A new termination clause probably to be added to all new war contracts provides for negotiation between the contractor and the contracting officer. If these two parties are unable to agree on a settlement, a formula would be employed for arriving at a figure. Should this formula be rejected the contractor could appeal to the Court of Claims, or an appeal board may be provided as an alternate recourse.

Settlement of subcontracts generally will involve only the prime contractor and his suppliers, although the government may enter into the negotiations if this should serve to facilitate the procedure.

Set Up Field Schools

Mr. Lewis urged contractors to take an immediate inventory upon termination of a contract. Eventually it is expected that a provision will become effective whereby the government is required to remove surplus material and equipment from the contractor's plant within 60 days, otherwise it would be held beyond that time at the government's risk. The Army Service Forces plans to set up field schools where industry representatives can be trained in contract settlement procedures. It is also planned to issue a guidebook, written in nonlegal language from the contractor's viewpoint and designed to inform him what he must know and do in settlements.

The speaker strongly recommended that all war contractors immediately appoint an individual or department to handle contract termination. He also urged that the duties and responsibility of the individual in charge be defined in order to minimize delays in effecting settlements.

A forceful address entitled "Free Men on the March" was given at the Wednesday luncheon by Samuel B. Pettengill, general counsel, Transportation Association of America. One of the basic problems facing the nation, he stated, is to dispel the notion that government can create purchasing power. The deficit financing that is necessary in wartime cannot be continued to promote peacetime prosperity, because only the creation of new wealth through actual production will pay for the debt already incurred. The speaker emphasized the need for increased participation by employes in business profits, and urged industry to sell the country not only its products but also the system of private enterprise which makes these products possible.

Another plea for preservation of the private enterprise system was voiced by Dr. George S. Benson, president, Harding College, Searcy, Ark., who warned that the country is drifting toward a planned economy. Only an intensive educational program will awaken public opinion to the danger of abandoning the economic system which has contributed so much to the industrial development of the United States, he stated.

Public Opinion Dominates

Discussing the labor outlook, Whiting Williams, industrial counsellor, Cleveland, cited the fact that public opinion gradually has become the predominating force in decisions affecting labor, and that the public is more willing to listen today to management's case than has been true for a number of years. He urged business to improve its industrial relations—with the individual worker, not merely with committees representing employes. Many workers, according to Mr. Williams, fear the possibility of peacetime idleness more than they do our national enemies, and it is up to management to make it plain that it too is concerned over this matter and plans definite steps to prevent postwar loss of jobs.

Reports on the work of various committees of the Steel Founders' Society of America were presented at the Wednesday afternoon session by chairmen of the groups. These included: Clarence Tolan Jr., Dodge Steel Co., Philadelphia, for the Advertising Committee; A. H. Thomas, Buckeye Steel Castings Co., Columbus, O., for the Research Fund Committee, and Lee C. Wilson, Reading Steel Casting Division, Reading, Pa., for the Technical and Operating Committee.

Representatives of government war agencies spoke at the Thursday morning session on matters affecting the steel casting industry. Regulations and policies applicable to steel casting prices were discussed by Warren M. Huff, price executive, Iron and Steel Branch, OPA, and by Stephen Van R. Spitler, head, Castings Section, Iron and Steel Branch.

George F. Hocker, head, Forgings and Castings Section, Steel Division, WPB, explained that while the expansion of steel casting facilities now is largely completed, and steel foundry output has been

(*Concluded on page* 134)

MORE CASTINGS

TARGET FOR WAR-TIME

● More production is the cry—more ships, more planes, more trucks—yet statistics continue to show a critical man-power shortage in the foundry industry.

If you can't get more men, multiply the output of the men you have by placing in their hands tools that have proved, during the trying months of war, their ability to do work faster—Master Pneumatic Hammers, Sand Rammers and Chisels. It can be done—

AND HERE'S THE PROOF

in comments from foundry operators giving the reasons why they prefer MASTER TOOLS—names on request.

PENNSYLVANIA—"They have more wallop than other hammers of the same type"

NEW JERSEY—"They make the job easier—the work cleaner—and speed up our production"

FLORIDA—"You have an excellent hammer—simple in construction and fast in action"

ILLINOIS—"They do the work with less fatigue to the men"

OHIO—"They have proven excellent. They do fast work and they are not too heavy"

VIRGINIA—"They are light and easy to handle"

IOWA—"Have more power and hit harder"

CALIFORNIA—"Easy to handle, fit the hand properly and have plenty of power"

FOR MORE WORK—WITH LESS FATIGUE—AT LOWER COST
SPECIFY THE "MASTER" LINE

PNEUMATIC HAMMERS • SAND RAMMERS • CHISELS

Immediate Shipment from Stock

WE ARE ALSO HEADQUARTERS FOR TOOL REBUILDING
Pneumatic tools of any make rebuilt by the "MASTER" Method with cylinders HARD CHROME PLATED to resist wear longer than the original cylinder. Prices on request.

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Rebuilders of all makes of Pneumatic Tools

(*Concluded from page* 132)

almost tripled since 1943, requests for castings from the government claimant agencies easily absorb available capacity. He pointed out that the fluidity of war necessitates constant revision in demand for certain types of castings, but that cutbacks in some directions—such as in the tank program—are offset by increased needs elsewhere.

Outlets where additional castings will be required this year include the railroads, farm equipment industry, and the military and civilian truck manufacturing program. Mr. Hocker praised the co-operation of the steel foundry industry in expediting delivery of castings where and when needed, and stated that WPB has found it necessary to resort to directives in relatively few instances.

Changes in policies of the Selective Service System eventually will react to the benefit of industry from the standpoint of labor supply, according to H. S. Colby, consultant to deputy vice chairman for production, WPB. The order in which men will be drafted hereafter is: 18 to 21-year-olds, regardless of whether or not they are fathers; non-fathers 22 to 38; fathers 22 to 38. There will be a heavy drain on the plant personnel in the youngest group, Mr. Colby pointed out, but since deferments for workers may be obtained only by those plants engaged in critical work the tendency should be for increasing number of older workers to shift from less essential industries. Plants seeking deferment for employes on the basis of irreplaceability must have filed a requisition with the United States Employment Service for replacement workers, and also must show that attempts have been made to provide substitutes through upgrading of less skilled men. Mr. Colby suggested that employers study the Selective Service System's bulletin on procedure for securing deferment of essential workers.

Claude L. Harrell, Sterling Steel Casting Co., East St. Louis, Ill., and chairman of the Steel Casting Industry Advisory Committee to the OPA, reported on the activities of his group the past year in consulting with OPA on pricing matters.

A feature of the Thursday noon luncheon was the presentation by Mr. Mount, society president, of the Lorenz Medal to T. H. Harvey, vice president, the Ohio Steel Foundry Co., Lima, O., and a past president of the Steel Founders' Society of America. This annual award recognizes the year's most outstanding contribution to advancement of the steel foundry industry.

Wilfred Sykes, president, Inland Steel Co., Chicago, addressed the luncheon meeting on "What Post-War Planning Is Not." Although conversion to peacetime production will be more difficult than was the changeover to war work, he said that the initial post-war industrial letdown need not be severe. Attitude of the government will have an important effect on future economic trends, he added, pointing out that a clear-cut decision by the government on its attitude toward private enterprise will be necessary for definite post-war planning.

STEEL FOUNDERS SHOW

How Castings Are Made

AN UNUSUALLY practical demonstration of foundry methods, from actual blueprints and patterns, through each step to the finished casting, was devised recently by members of the Eastern Division of the Steel Founders Society of America and set up, together with a melting furnace in full operation, in the Hall of Prime Movers at the Franklin Institute, Philadelphia.

The lecture and demonstration procedure is handled by John D. Miller, a former foundryman, who discusses step by step production of castings for college, grade school, technical trainee, or apprentice groups who may be contemplating a foundry career. Demonstrations open to the public began Jan. 11 and will continue for the duration.

Fifteen leading firms in the foundry industry contributed the material, including: Ajax Engineering Corp., division of Ajax Metal Co.; American Steel Castings Co., Atlantic Steel Castings Co., Birdsboro Steel Foundry & Machine Co., Crucible Steel Casting Co., Deemer Steel Casting Co., Dodge Steel Co., General Steel Castings Corp., Hartford Electric Steel Corp., Lebanon Steel Foundry, Penn Steel Casting Co., Pennsylvania Electric Steel Castings Co., Reading Steel Casting Division of American Chain & Cable Co. Inc., Treadwell Engineering Co., and Vulcan Iron Works.

Philadelphia, Wilmington, Del., and Chester, Pa., representatives of Steel Founders Society of America presenting exhibit to the Franklin Institute. Dr. Henry Butler Allen, director of the institute (fourth from left) inspects first casting

Using Alloy Scrap

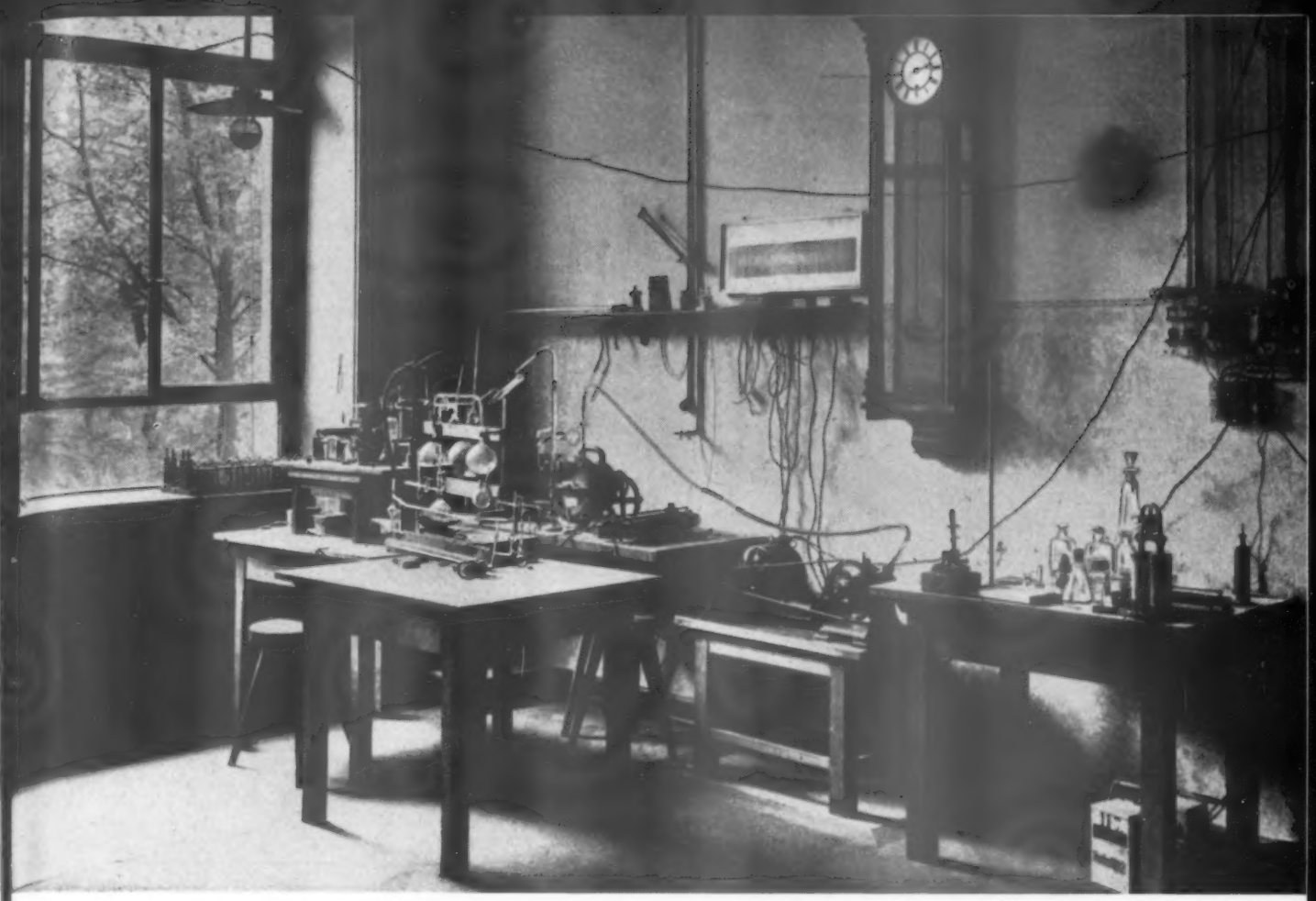
(*Concluded from page* 113)

variation of heat treatment according to the physical properties desired. Since using this practice we have been placed on a quality control basis for 4C2 steels by the Ordnance Department after testing 20 consecutive heats. A fairly close control of physical properties can be obtained by controlling the brinell hardness as shown by the average results in Table IV obtained from our regular production tests on oil quenched and drawn steels.

It has been found that besides the economy in conserving alloys from this type of melting, there are other economies such as decreased melting time, decreased power consumption, easier operation, and more consistent results from less experienced melters which we are forced to use due to increased number of melting units and melting schedules.

By calculations based on average finished analysis and the ratio of scrap to foundry alloy returns, it is estimated that from these 272 tons of alloy scrap the following has been conserved and utilized to a good advantage: 4884 pounds of chromium; 5451 pounds of nickel; 1300 pounds of molybdenum.

From this test run, we believe that 30 to 40 per cent of alloy scrap (purchased) can be melted in addition to foundry returns, depending upon the alloy specification and the analysis of the scrap available. At present schedules, we contemplate using 500 tons of these alloy scraps each calendar month.



Photograph of Professor Röntgen's laboratory in which he discovered the x-rays—University of Würzburg, Bavaria, Germany, November 8, 1895. Illustration is from the book, "Wilhelm Conrad Röntgen," by Otto Glasser, Ph.D.

March 27, 1845—February 10, 1923

Röntgen

Tomorrow's improved designs owe much to this old lab

RÖNTGEN'S x-rays, widely used first in medicine, went to work in industry many years ago, but on a relatively small scale.

They've been trouble-shooters, uncovering hidden flaws, weeding out defective castings. They've been trouble-preventers, pointing the way to greater safety through improved technics—as in foundry work and in welding, for example.

Now, they are becoming one of the industrial designer's more important tools. And it's a foregone conclusion that many a postwar product will be a better product because radiography helped in the designing.

Because the designer can count on radiography's penetrating examination to demonstrate adequate strength, he can safely turn to lighter parts; he can reduce wall thickness, trim off heavy, awkward shoulders.

Radiography helps give him a wider choice of technics . . . for example, the use of castings vs. forgings.

Lowered manufacturing and selling costs, savings in material, time, and transportation will often follow.

To help radiography do both its jobs better, (1) detect trouble, and (2) point out the way to improvement, Kodak supplies a line of special films, solutions, and accessories . . . and makes available the experience which has been accumulated in 16 years of research in this field.

EASTMAN
KODAK COMPANY

X-ray Division

Rochester, N. Y.

the adventures of BILL

BY PAT DWYER

Drawings By RICHEY

WELL fed, rested, lazy and comfortable the other night, I reminded Bill that the dismal winter was nearly over. Soon the wild geese would be honking overhead on their annual pilgrimage to the far northern silent and lonely nesting places. Ice would disappear from the lakes and rivers. Crocuses and daffy down dillies would be shyly pushing their delicate noses above the ground. Trees, shrubs and fields would show a tinge of green and almost over night the great annual miracle pageant in which nature changes from a withered old crone to a gorgeous maiden of glory and light, would be with us.

Bill was not impressed by these optimistic views and sage observations.

"The geese may be flying," he said, "but whoever heard of a goose having any sense? That silly trick of flying thousands of miles north and south every year probably is one of the reasons for the popular opinion of the goosey nit wits. As a friend and well wisher I would suggest that the crocuses and daffy down dillies hesitate a trifle longer before showing their dear little noses. J. Frost still takes an occasional walk abroad and he loves to tweak dainty little noses. The annual pageant of covering the dingy old earth with a gorgeous mantle of green will come, but you had better stick to the long woolies for another month or two. In fact that probably is all you will have left after your Uncle Sam has run the financial vacuum cleaner over you and in addition has converted you into a candidate for the nut house from trying to understand the forms containing his request for handing over the Stuff. Have you looked over these worst examples of the English language ever seen in printed form?"

I admitted I had seen these weird examples of financial brain storms, but I had made no attempt to understand them. What's the use? Nobody understands 'em.

"Which I admire to say," said Bill, "is the truest words I have heard dribble from your lips in many a long day."

"What's the idea of dragging in an imitation of the cow country talk of a past generation? Have you by any chance been browsing through Zanny Grey again?"

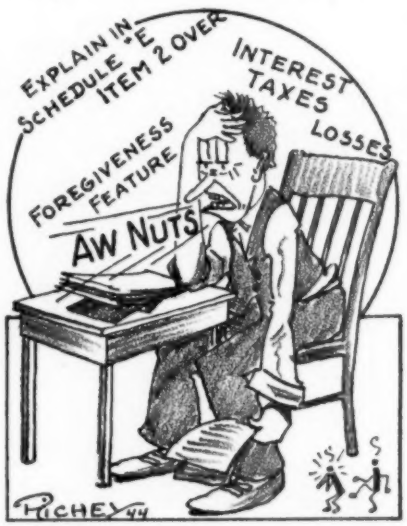
"Your comment on the unreadable income tax instruction sheets, reminded me of a letter I had the other day from an old friend of mine in the Far West. It is all that a letter should be, simple, straightforward and as limpid and clear as the little stream in the meadow back home where you caught your first trout. Listen:

Dear Bill:

Last fall some time, probably September, I was reading in THE FOUNDRY about this here guy Sam and how he learned the trade, and through one thing and another memories of my own young days in the old Ball Foundry & Machine Works came back to me.

That is exactly the way I started, but in spite of the hard work, the long hours and the small pay us kids had a lot of fun. I learned how to chip out the old Q-blow, daub her up, put in the bottom and line the spout as slick, straight and smooth as a whistle and then take care of the ladles, hustle up the kindling, iron and coke, make up the charges, light her up and charge her and turn on the wind. Then I would run up on the charging floor as nimble as a cricket, put in some more coke and a dash of lime rock, come down and tap out, bot her up and dash up again to throw some more stuff into her. That was one Q-blow that wasn't always kept even with the charging door during the heat.

Then while I was resting my hands and face I would be allowed to make the smaller cores and snap molds, fire up the oven and mix facing, tramping it off and cutting it over several times to mull it into condition to suit the taste of some cranky and crabby molder. I had to mix claywash in a half barrel partly sunk in the floor—what a smell—repair flasks and patterns, clean shovels, chip and grind castings and unload the old rusty and wheezy rattle box, enveloped in a cloud of dust.



He was never the same again

I also found time to make all the trick castings, the double arm pulley, with arms and ring for pattern and believe me that is a cute little trick and I am also here to tell you the pulley with single arms with arms and pulley ring for pattern ain't no slouch. The cup saucer and spoon is one that will make them stop and think over once or twice and so will the caged ball and the four leg horse. Then we used to experiment with the different ways of making sheaves. Some widely traveled guys claim there is only seven ways to make a sheave—the home guards only know one—but I know of 13 or 14 ways and there are probably as many more if a fellow was to dig 'em up.

Maybe you don't remember me Bill, but I am the lad that wrote you about the cupola without a wind jacket, and about the guy in Milwaukee that left the waster in the pit as a monument of what can go wrong with a casting. They had to knock the risers off and work over the top of it from then on, account the crane couldn't pull the mess out of the pit. The iron in the mold found its way down among the rails and grids and stuff he had in the bottom of the pit and might even have got tangled up, in and around the sewer and water line, besides all the bird nests and cobwebs catching fire in the roof when she started to blow. He grabbed his paper of Polar Bear, his coat and ⅜-inch lifter, his trowel and double ender and flew out the door before she stopped blowing and never even came back for his back time. Some traveler, hey?

I could tell you some more about some of 'em bursting out, but I ain't got the time just now. Instead I guess I'll tell you about another little happening that was experienced not so long ago out here on the backbone of the Rockies, or rather just where the rolling prairie butts up against Pike's Peak. It was in a little shop that consisted of

(*Continued on page* 139)

Cranes and tracks for pouring.

Electric hoists aid handling.

Ideas FOR POST-WAR PRODUCTION

Here are several American MonoRail installations which have proven successful in low cost handling. Any plans for postwar production should include such handling methods.

Regardless of the size or type of application, American MonoRail Engineers can help. Their specialized experience often uncovers hidden possibilities for simple systems that bring immediate returns. Consultation with these men is available without obligation. Write for copy of Bulletin C-1 showing a wide range of installations.

Speeds up distribution of hot metal.

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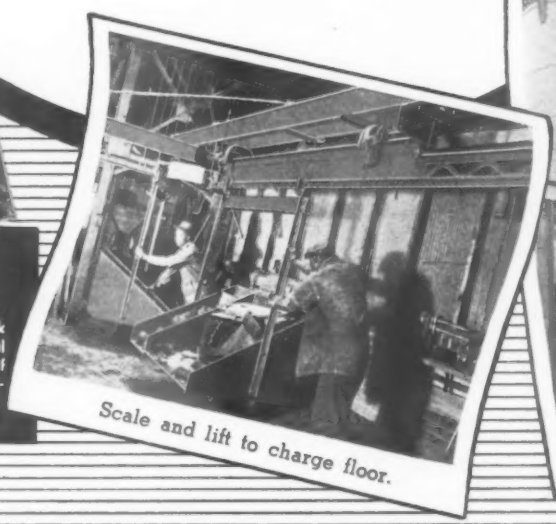
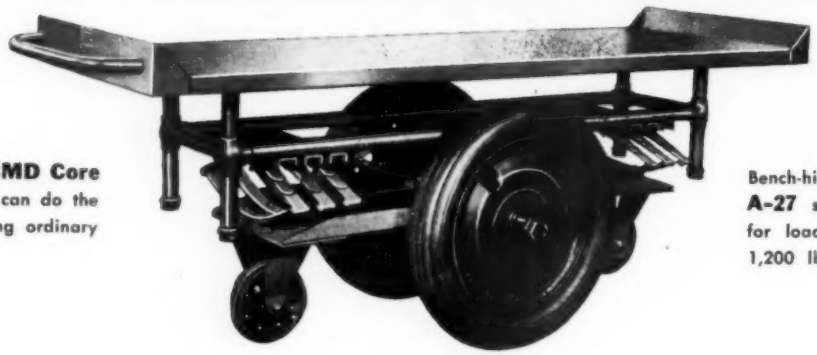
SEND FOR BULLETIN C-1

A 56-page book showing successful applications of American Mono-Rail Systems.



Scale and lift to charge floor.

Mechanical charging brings better metal.



With **Type A-27 CMD Core Trucks,** two men can do the work of 3 or 4 using ordinary conveyances.

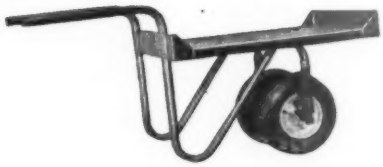
Bench-high steel trays on **Type A-27** speed loading. Three sizes for load capacities of 1,000 lbs., 1,200 lbs., and 1,400 lbs.

FEWER MEN

Carry Cores Faster with

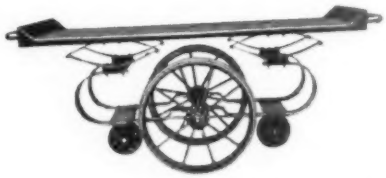
PNEUMATIC CORE TRUCKS

In crowded places throughout your foundry, this single-wheel **CMD Core Barrow, Model C-1,** is mighty easy to handle.



For heavier loads, the two-wheel **CMD Pneumatic Core Barrow, Type C-2,** provides easy maneuverability with extra strength and full protection for cores.

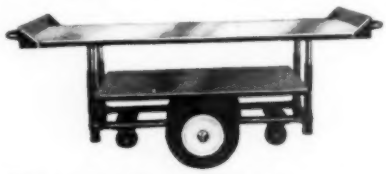
Light and heavy loads can be carried with complete safety by the sturdily built **Model A-27-J Core Tru :** Loading platform is 27" x 60" long. Loading capacity is 600 lbs. Elliptical springs and inner coil springs in the uprights assure correct resiliency.



The resilient chassis of **Type B-1 Core Truck** is made of spring steel properly heat-treated and includes intermediate elliptical springs for maximum cushioning protection. The solid rubber tired, steel-spoked wheels have Hyatt Roller Bearings. Load capacity, 700 lbs.

Meet the man-power shortage in your foundry with CMD Pneumatic Core Trucks. They cut handling costs 50 to 75 per cent and assure maximum protection for the cores.

Pneumatic tires plus specially designed springs absorb shocks and vibrations that cause chafing and core breakage. All upright supports have an exclusive inner coil spring for maximum resilience even under light loads.



Model D-1 Core Truck has two loading trays and is sturdily built to give years of service at moderate cost. Load capacity, 600 lbs.

Write for Free 4-page folder on CMD Core Trucks and other Foundry Specialties.

CHICAGO MANUFACTURING & DISTRIBUTING COMPANY

Dept. 3F, 1928 West 46th Street Chicago, Ill.

Manufacturers of a complete line of core-conveying equipment and foundry specialties.

(*Continued from page* 136)

nothing but a cupola, four walls, a roof, a few piles of sand and a jib crane that might lift a ton and a half with a kick and a push and a generous dose of real enthusiastic camp meeting language.

The shop turned out mostly stove guts and the lighter stuff in the mining and milling line, municipal castings with an occasional 900 or 1000 pounder. Everything went along pretty smooth, and taking it by and large, it wasn't a bad place to work for a short time. One day an order came in for 10 big pots. Not the super doopers made in some of the eastern foundries, but certainly oversize for this here place I am telling you about. Two to be delivered right away, meaning as soon as possible and the balance of the lot at the rate of one a month. The customer supplied the pattern, but we had to build the flask and other rigging. After due discussion by all hands it was decided that it was practically imperative to cast the pots bottom side down, otherwise there would be difficulty in securing clean, dense metal at the bottom where it was needed to serve the purpose for which the pots were intended. Of course it would have been easier in this particular case to cast 'em bottom side up, but you know Bill the foundry always has to do things the hard way. This may be one of the results of original sin. I wouldn't know about that.

The pot was somewhat oval in shape, and the flask which was all made of wood including the bottom board was 9 x 11 feet inside. The cope was 1 foot high, making its capacity about 99 cubic feet. Including the sand in the belly and a 400-pound arbor, also rods, gaggers, bolts, cross rails on top of the cope, chains on the hook and other incidental hardware we figured roughly we would have an 8 or 10-ton load to lift. And us with a jib crane that a ton and a half would make 'er holler like a stuck pig or two pigs under a gate.

When the slight difficulty of lifting the cope was mentioned diplomatically to the gaffer he said: "Nothing to it, boys. Go right ahead and get her ready. I'll find a way to lift the cope. I know where I can hustle a big truck with a long snout and a winch on it. This winch will lift absolutely anything that has two loose ends, let alone a little cope like that. Ha, ha. We will hook the winch on to one end of the cope, and the crane on to the other end and with what chain blocks we got around the place we will lift the cope as easy as one of you bums can lift a can of beer. Then we'll build a sheet iron platform over the hole in the drag and finish and dry the cope overhead. Alley oop!"

Due to lack of head room and weakness of rigging it was decided to bury the drag in a hole in the floor and reinforce it by ramming heavy hunks of iron and sand tightly against it after the mold was assembled and clamped up.

Well, Bill, we leveled up the drag on the bottom board in the pit, shoveled in a few cinders and sand and rammed up a bed. We took some planks and nailed them across on the lip of the pattern and then lowered the pattern into the drag. The planks of course supported the upper edge level and flush with the top of the drag. Then we spiked the planks to the drag joint and rammed sand under and around the pattern up to the joint. At this stage the planks were removed and in due time the belly and cope were rammed up and the arbor properly bolted up to the cope in the most professional manner before too many suns had gone down in golden glory behind Pike's Peak and all that there kind of poetic stuff.

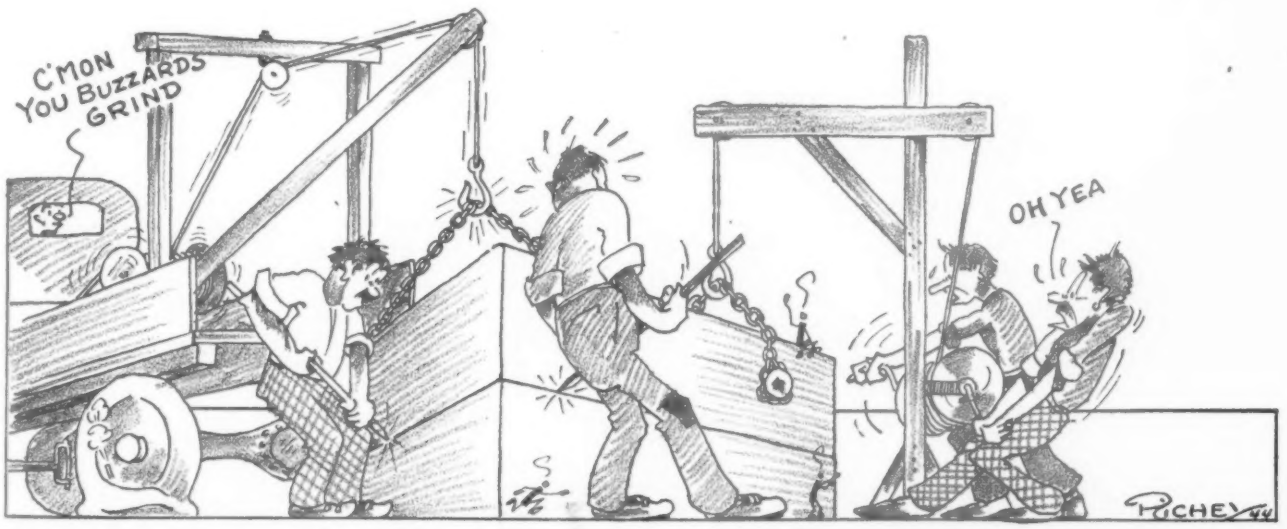
When all was ready, the aforementioned truck with the snout hanging over the stern was backed into the foundry, chain blocks and crane hooked on and all the lifting machinery duly started. To make a long story short, the crane and the chain blocks did lift one end of the cope about an inch, but the truck didn't do nothing but make a lot of blue smoke, and flatten the tires and sit down on her springs like a brooding hen, and everything around the place was creaking and groaning and straining etc., including the boss.

It was seen that the idea wouldn't work so we held another council of war. The boss said he knew where he could hustle a couple of heavy duty chain blocks with a trolley attachment. So we spent the night reinforcing the roof with beams and fixed an 8-inch I-beam up there and put the chain blocks on it. The next morning the cope was wrestled off, high enough to clear the drag and with foundry language and bon mots suitable to the occasion. We could even trolley the cope off the drag with the aid of another chain block pulling on the trolleys so we could work on the drag.

I don't think the heavy chain blocks were over 3 ton rated capacity each, but we got by as the saying goes on a wing and a prayer. I sure thanked the maker of them there blocks to myself for putting good material in his wares, or somebody would have got hurt or crushed if anything had give, or if a pin had sheared. To make matters worse, the lifting chains were so heavy and massive they wouldn't ride down in the curve of the hooks, but rather up near the points. We measured the hooks before we started to lift and again after they had the full load on them and found they had sprung only a little over ⅛-inch and didn't snap off or anything. Good old chains and hooks. I believe they could have lifted a battleship.

Well anyway Bill, the mold was finished and dried and closed. We made provision for the vent out of the hole and clamped 'er up from the battens on the bottom board to the rails on the top and rammed 'er up on the outside. I never did like to pour no pot without some weights or heavy rigging across the cope on account of the tremendous lifting pressure of a casting of this type. There wasn't enough weights around this dump to hold her down so we built a cribbing of railroad ties from the cope clear to the roof and put some railroad jacks on top of the crib and jacked her down

(*Concluded on page* 195)



Oh, what do we do in the foundaree? We lift and lift and lift. What do we get? Oh, nuts

BY A. H. ALLEN
Detroit Editor,
The Foundry

A PICTURE of the difficulties surrounding operation of independent iron and steel foundries over the past year is painted in the annual report of Lakey Foundry & Machine Co., Muskegon, Mich. We can do no better than quote in part from remarks made by President J. O. Ostergren in his report issued early in February:

"Sales volume of steel and iron castings produced during the year (1943) were about equal, and while earnings from steel operations were satisfactory during most of the year, such earnings were largely dissipated by losses from gray iron operations. Factors attendant to the losses in the iron foundry were pronounced in that prices of iron castings as regulated by the OPA were inadequate to absorb the cost of production brought about by an acute labor situation.

"An existing shortage of skilled foundry labor evidenced itself early in the year and by April became so critical that production was seriously curtailed. Despite efforts to retain them, workers were constantly migrating to plants other than foundries where higher wages and better working conditions prevailed. Also many of the regular employes were recruited into the armed forces through Selective Service. Regulations and 'freeze to the jobs' orders as prescribed by the WMC subsequently became effective and while minor improvement was attained the situation generally continued to be acute.

Import Southern Labor

"Special orders permitting the company to recruit workers in southern states were issued by the WMC and after the local labor supply was exhausted the company was successful in obtaining approximately 600 workers from that area. Importation of such inexperienced foundry labor contributed to a high percentage of defective castings and other inefficiencies which increased costs.

"As the labor situation became worse, losses in the iron foundry increased, and profits in the steel foundry decreased. By July 31 the company had filed several applications for increased selling prices of gray iron castings with the OPA. Steel prices were reduced under general and special orders, but were partially reinstated as of Sept. 18.

"The special orders issued by the OPA providing for price increases were not adequate to absorb the rapidly increasing costs, and in August the company notified its customers and the WPB that prevailing selling prices were not sufficient to maintain two-shift operations in the iron foundry and that in the interest of economy the company had no alternative but to operate on a one-shift 48-hour week basis, or receive additional price relief. The WPB rigorously opposed such curtailment in view of the fact the iron castings produced by the company were vitally needed by the armed forces. On Aug. 25 a special meeting was held in Washington with representatives of the WMC, WPB, WLB, OPA, the armed forces, customers and others to discuss the company's labor problem. Subsequently, permanent representatives of the armed services were assigned to the company and task committee meetings scheduled for the purpose of solving labor and production problems.

Need Higher Prices

"Contract with the UAW-CIO expired July 1 and a new contract is now being negotiated. Several issues including increased rates of pay and issues involving increased cost of production have been certified to the regional WLB. At hearings called by a representative panel the company pointed out that it was not in a position to absorb further increases in its cost of production and should the board grant such increases then joint approval be obtained from the OPA for commensurate adjustments in selling prices.

"The program instituted by the WPB included their recommendations that additional comfort stations, showers and cafeteria be provided for employes. The management, after careful consideration, made formal application to the WPB to sponsor and the DPC to finance the erection of a new service building and equipment together with certain other productive facilities at a cost of approximately $343,000. Approval has been obtained and construction started. Although the company will not finance the cost of the new construction, it will be required to pay rental charges of approximately $20,000 a year to the DPC for use of the facilities.

"It is to be recognized that operating results in the future depend not only on the quantity of labor, but the type of skilled foundry labor available, and further, that after all possible management economies have been effected, adequate selling prices are essential."

The labor situation in Muskegon continues highly critical, so much so in fact that the WMC has placed employment ceilings on every business establishment in the area, providing that the level of employment can be no higher than the peak for the 30-day period ending Jan. 25, and that all male hiring shall be on a controlled referral basis through the U. S. Employment Service.

Sharp increase in the landing craft program, calling for increased quantity of engine castings produced in Muskegon foundries, was one reason for the complication of the Muskegon foundry outlook. This, plus the fact Continental Aviation & Engineering is now in process of gearing up a new assembly and test plant to handle output of something like 1300 Rolls-Royce airplane engines a month, called for drastic action. Procurement branches of the military services gave some help by transferring certain castings contracts outside the area.

Plan To Open Buick Foundry

Some Ford work, for example, was moved to Birmingham, Ala. Meanwhile, plans were being drawn to reopen the Buick gray iron foundry at Flint to handle production of cylinder blocks and heads for Hercules engines which were being supplied by Campbell, Wyant & Cannon. Readjustment of airplane engine schedules at Buick and termination of a steel shell case contract have resulted in layoffs of around 4000 at Flint, so it was believed there would be a minimum of difficulty in staffing the gray iron foundry which has been idle for 2 years. However, late reports from Muskegon cast some doubt as to whether the plan will go through in view of the fact Hercules may have overestimated its casting requirements.

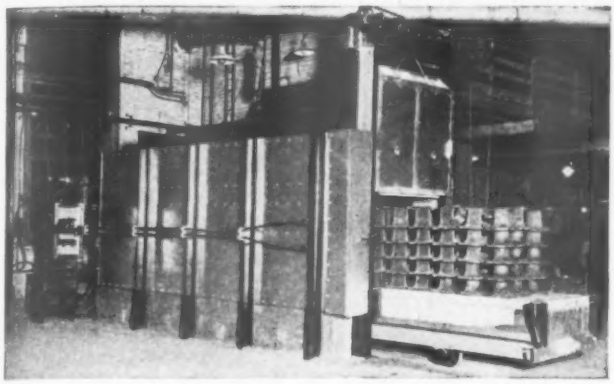
Muskegon foundries have felt in no small way the impact of unionization on wage rates. Cupola chargers now receive as high as $1.40 an hour, and it was not many years ago when this class of help in Muskegon was earning only 60 or 70 cents an hour when the rate in Detroit plants was $1.10. Here lies

(*Concluded on page* 142)

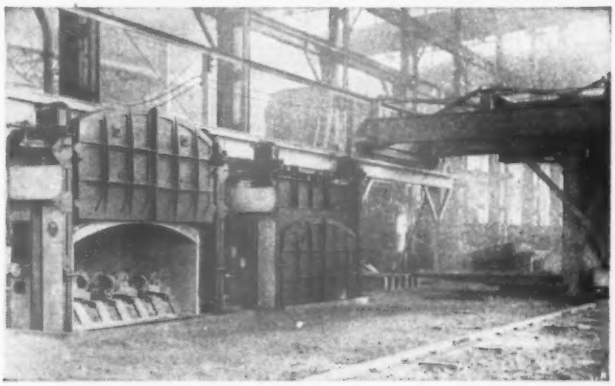
EF FURNACES

For Every Industrial Heat Treating Process

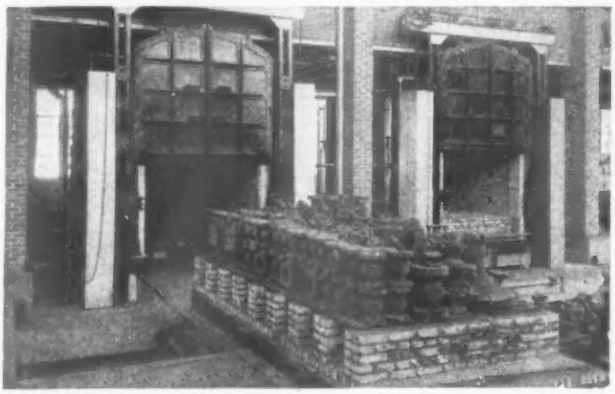
Some EF Fuel Fired and Electric Production Furnaces for Annealing and Heat Treating Castings



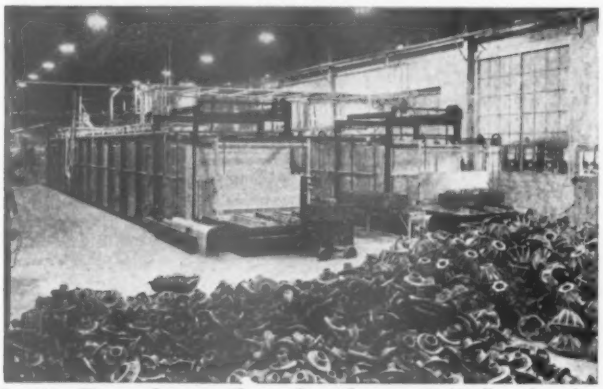
Magnesium & Aluminum Castings are uniformly treated in various designs of EF pit type, car type and other batch and continuous type furnaces.



Heat Treating Tank Armor. Heavy tank armor castings, railroad castings and other large parts and products are heated and quenched in EF units similar to above.

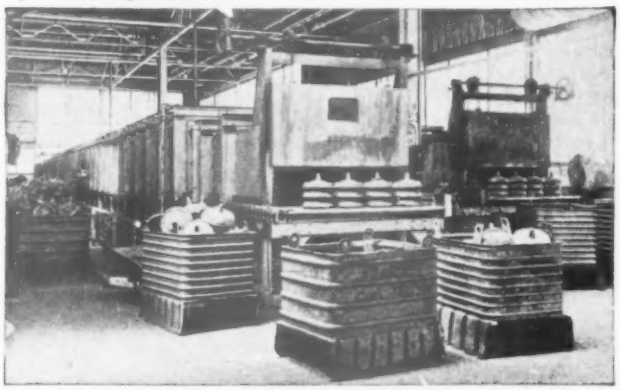


Car Bottom Furnaces. EF car type furnaces are built in any size, with single chambers, multiple chambers with cross transfer car, or with quenching means as required.



Scale Free Annealing Castings. 40,000 lbs. of castings per day are annealed absolutely scale-free in the above EF continuous special atmosphere short cycle annealing installation.

Recuperative Type Furnaces. This EF return recuperative type anneals castings uniformly and continuously. The heat from the outgoing castings preheats the incoming castings—saves fuel.



Annealing Large Castings—Continuously. Two EF oil fired furnaces annealing large alloy castings uniformly and continuously. The castings are carried through on roller hearths.

We solicit your furnace inquiries—we build furnaces for any process, product or production

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production

(*Concluded from page* 140)

the principal explanation for the pressure to permit higher selling prices for iron castings.

Experience with importing southern labor in Michigan foundries has not been too encouraging. Many of them are momentarily attracted by the high wages offered, but soon become weary of the hard work and the cold weather, and drift back to their native habitat. One estimate is that foundries in the state could now use 25,000 laborers. Suffice to say they will not get this number, or anything like it.

Steel foundry operated in Detroit by Kelsey-Hayes Wheel Co., which for a time was producing castings for combat tanks has passed into history. Through some operating difficulties, it is reported number of expensive castings were rejected because of defects, and the foundry was closed. Shortly thereafter, wrecking crews descended on the plant with sledge hammers, crowbars and burning torches, completely dismantling the equipment, cutting up conveyor lines, furnaces and other facilities into what was little more than scrap. Machinery is now being located in the plant for handling machining operations on Rolls-Royce engine cylinder barrels for Packard.

A.F.A. War Foundry Congress Plans

(*Continued from page* 110)

with heading and gating procedures and technique, should prove of special interest. This part of the program continues the successful policy of presenting malleable symposiums at several past conventions. Some of the papers included in the malleable program will deal with pulverized coal firing of malleable annealing and melting furnaces; malleable mixture calculations and melting control; heat flow problems; coin pressing malleable castings, and physical properties developed by isothermal quenching of malleable iron.

A large number of papers will be offered steel foundrymen attending the congress. These will be divided into four general types covering the following: Steel sand problems, hardenability and heat treatment, physical properties of steel castings, and nondestructive testing methods. Of the papers on steel foundry sands, one will deal with the use of cumulative curves in foundry sand control, and another will discuss high-temperature properties of steel sands. On the latter subject, several contributions will be offered.

Will Discuss Heat Treating

Three papers are scheduled on hardenability problems, and an additional paper on problems in heat treating castings made from air-hardenable steel. On the subject of physical properties, one author will deal with properties of low-alloy low-copper copper-bearing steels; another, with recent steel castings developments; a third, with test bar molds for steel castings. Several papers also will be presented on nondestructive testing methods, including important committee reports.

The A.F.A. Brass and Bronze Division is sponsoring several interesting presentations this year, including a paper on nonferrous melting in the cupola. Other papers dealing with melting problems and procedures include a discussion of shrinkage porosity in bronze alloys, a paper on melting red brass and tin bronzes in open-flame and crucible furnaces, and still another on the effect of temperature, water vapor and carbon reaction in various types of brass melting furnaces.

Molding, melting and processing procedures are among the important gray iron problems to be considered at Buffalo, on the program prepared by the Gray Iron Division. Papers discussions will include ladle treatment of cast iron; factors in superheating and its effects; some phases of cupola operation and properties of gray cast iron; a study of molding methods to produce sound castings; molding steam cylinders for marine engines, and method of preparing gray iron for subsequent processing.

Several papers of unusually timely interest will be presented by the Program and Papers Committee of the Pattern-making Division, such as the use of plaster for foundry patterns, a subject that has received more attention recently. Of still greater importance to the industry will be the discussions on securing co-operation between the foundryman and patternmaker.

The increasing attention given lately to centrifugal casting of metals is evidenced this year by presentation of a symposium of six or seven papers, dealing not only with problems and methods of production but also the engineering principles involved in various phases of construction of centrifugal casting machines. Of particular interest, perhaps, will be a paper on the new "investment molding" process.

To Cover Wide Range

The 1944 program, as now planned, will offer many general interest papers covering a broad range of subjects. On the subject of plant and plant equipment, papers will be presented on small foundry conveyorization, and maintenance in relation to foundry equipment. Manpower and training problems will, as usual, include discussions of foreman training, women as foremen, training foremen to handle women employes, the conference room method of training, and development of foremen for the post-war period.

Analysis and testing methods are expected to be fully discussed at Buffalo. Of the papers on analytical methods for cast metals, two papers will deal with spectrographic analysis, and one on the combination method of analysis for iron and steel. The committee charged with this phases of the program is evolving an excellent group of subjects.

The recently formed Inspection Committee of A.F.A. will have its own program for the first time this year and a large turnout is expected on this all-important subject. A gray iron shop course is planned on the analysis of causes of defects in castings. Papers also will be presented on welding, and the chill test as a foundry control method.

In the field of refractories, papers will be considered on drying of foundry ladles and high-temperature heat insulation. The Committee on Co-operation with Engineering Schools will present a program dealing with the employment of technical school graduates in the foundry industry.

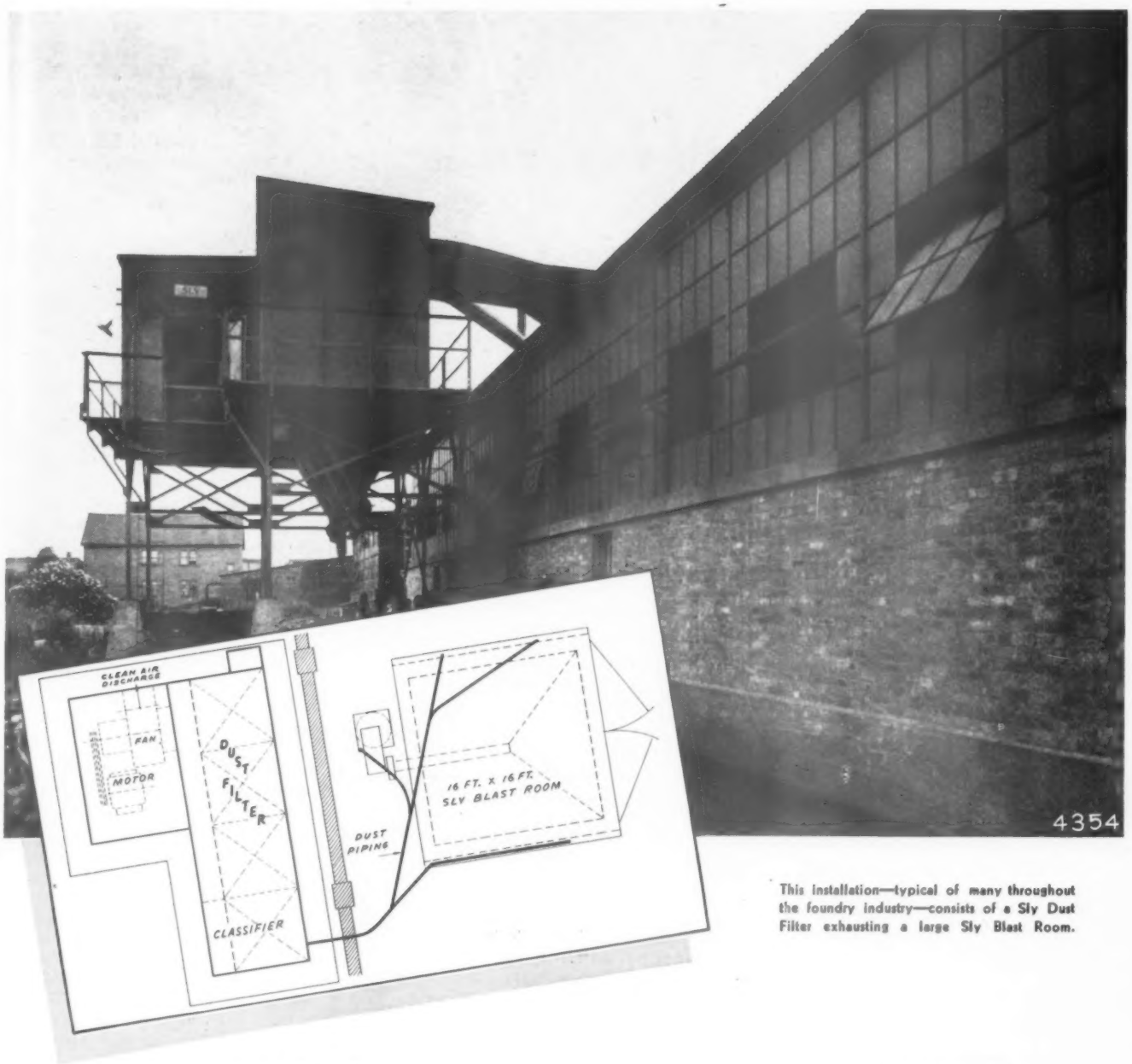
Of interest to many personnel men will be the discussions sponsored by the Committee on Job Evaluation and Time Study. One important phase of this work relates to the application of time studies in war time. Another will be a discussion of government rules and regulations on incentive work, presented by a member of the War Production Board. Special war production sessions also will be sponsored on the vital question of manpower problems, with outstanding speakers offering helpful information for plant executives.

Needless to say, there will be a number of round-table and similar "off-the-record" sessions offered this year, sponsored by the various divisions of the association. The always-popular shop operation courses again will be held, and the attendance of shop men is expected to be unusually large.

Requests for hotel rooms during the Buffalo Foundry Congress now are being considered by the A.F.A. Housing Bureau in Buffalo, and definite assignments soon will be made for all who have sent in applications. Because of hotel conditions prevailing everywhere today, the association has requested those planning to attend to make joint reservations wherever possible.

The association has announced for this convention a plan for taking care of service men that is perhaps unique for wartime business meetings. Believing that men in uniform who come to Buffalo during the week of the congress, whether on furlough or on orders, are entitled to "priority" in accommodations, the Housing Bureau has been instructed to withhold 10 per cent of each hotel's convention commitments. In case these rooms are not required for service men, they will be released on a day-to-day basis to men attending the meeting.

Mall Tool Co., Chicago, recently was awarded the Army-Navy "E" pennant with one star, signifying renewal of the flag won originally by the company 6 months previously.



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WISCONSIN CONFERENCE

Covers Wide Range of Topics

By PAT DWYER
Engineering Editor
and
EDWIN BREMER
Metallurgical Editor
THE FOUNDRY

WITH a registered attendance of 597, and 650 present at the annual banquet the Wisconsin Chapter of the A.F.A. staged a most successful seventh annual foundry conference at the Schroeder hotel, Milwaukee, on Feb. 10 and 11. Sponsored by the chapter in co-operation with the University of Wisconsin, the conference comprised 24 technical sessions, two luncheons and the banquet. The conference opened with a luncheon on Thursday noon Feb. 10 at which George Dreher, Ampco Metal Inc., Milwaukee, and chairman of the chapter welcomed those present. He turned the meeting over to Prof. E. R. Shorey, University of Wisconsin, Madison, Wis., who introduced Dean F. E. Johnson, college of engineering of the university, who spoke on the "University's Function in Training Men for Industry". Dean Johnson pointed out that industry needed intelligent co-operation between management and labor, intelligent business management, and excellent technical design and operation. Hence, better than ordinary men will be required to accomplish those objectives, and it is the university's task to train such men. Methods would include specialized and extension courses for those already in business, and training the younger generation to meet future problems.

Principal speaker at the banquet held Thursday night was C. A. Dykstra, president, University of Wisconsin, who pointed out that in time of war, we should prepare for peace. While the war is far from being won, steps should be taken to consider all the possible factors involved which will lead to a permanent peace.

At the luncheon on Friday noon, J. H. Van Deventer, editor, *Iron Age*, spoke on "Forecasting the Future of the Foundry Industry", and stated that relatively speaking the foundry industry was an infant. During the past 3 or 4 years it had gained about 10,000,000 tons, and the present casting production capacity was about 20,000,000 tons a year. Its future lies in the unexplored areas of application rather than in replacing other established methods of fabrication. Mr. Van Deventer said that every foundry should have a cost system, and that technical and market research is required. Merchandising policies must be upgraded, and the industry must grasp the opportunities presented through the numerous new developments. He said he believed that the greatest possibilities for foundries lie in specialized or tailor-made castings for specific applications.

During the meeting four sessions were held on malleable cast iron. The first held Thursday afternoon was under the direction of E. Hansen, Wisconsin-Appleton Co., Appleton, Wis., with C. H. Lorig, Battelle Memorial Institute, Columbus, O., as the speaker. Mr. Lorig spoke on "Some Factors Which Speed Graphitization of Malleable Iron". Means include control of annealing temperature, of composition, character of raw materials, melting and casting conditions; all of which affect the rate at which iron will graphitize.

Silicon Is Important Variable

Silicon is the important variable in composition, and the higher it can be without causing primary graphitization, the more rapid will be the rate of first and second stage graphitization. Total carbon seems to have little effect on graphitization rates. High manganese will retard graphitization moderately in the first stage, and effectively retard it in the second stage. Copper accelerates graphitization during both stages, and it appears that 1 per cent copper is about as effective as 0.5 per cent silicon in annealing, but only equivalent to 0.1 per cent silicon in promoting mottling. Hence, by adding 1 per cent copper, and reducing the silicon 0.1 per cent, the iron will graphitize as rapidly as an iron containing 0.4 per cent more silicon.

As annealing temperature is raised, graphitization proceeds at progressively increasing rate, and with higher temperature more numerous and smaller temper carbon particles are produced. Raw materials have a profound effect on rate of graphitization, as shown by Boegehold and Joseph. Steel additions appear to increase the carbide retaining power. Superheating during melting results in decreased mottling, often permitting use of higher silicon in the iron, and also decreases malleablizing time. The more rapidly the casting can be cooled after pouring, the faster the rate of graphitization, hence thin section castings malleablize more rapidly than heavy section castings.

Low pouring temperature is believed to produce fine-grain iron suitable for short time annealing. More effective in short cycle annealing is heating to annealing temperature more slowly. With short cycle anneals a preheat treatment at 600 degrees Fahr. for 3 hours increases graphitization rate and formation of small temper carbon particles. In laboratory work, bubbling hydrogen through the melt previous to casting resulted in remarkable increase in graphitization using the preheat treatment.

Second session on malleable was held Thursday afternoon with Robert Osborne, Lakeside Malleable Casting Co., Racine, Wis., as chairman. J. G. Jackson, Ordnance Department, Washington, pointed out that numerous parts in ordnance have been made from regular and pearlitic malleable irons which are giving excellent service. He mentioned that the Ordnance Department had been agreeably surprised by the high rate of machinability of malleable. Mr. Jackson thought that use of shot peining the surface of malleable castings might increase fatigue life, as in the case of steel parts, and suggested investigation along that line. He mentioned that reports from Great Britain indicated that white heart malleable was being used in brackets and tank treads. The latter were quenched in oil to provide a hard surface. In some cases peeling was encountered, requiring cast on lugs on the castings which were fractured, and examined for any indication of peeling.

Third malleable session was held Friday morning with Prof. Richard Schneidewind, University of Michigan, Ann Arbor, Mich., as the speaker, and Steve Pohl, Federal Malleable Co., West Allis, Wis., presiding. Prof. Schneidewind said that the factors which influence annealing, and especially the uncontrollable factors which result in nonuniformity, include basic composition, carbon and silicon; common impurities sulphur, phosphorus, manganese, and oxides; rate of cooling; melting and casting procedures; raw materials; annealing procedures, and alloys or additions. A proper balance must be maintained between carbon and silicon to obtain a true white iron, and to secure graphitization in a reasonable time. While higher carbon may be desirable for ease of casting, it must be reduced to gain increased strength. For example a very low carbon steel containing 1 per cent silicon has a tensile strength of about 70,000 pounds per square inch, and an elongation of 40 to 42 per cent. Presence of about 2 per cent carbon

(*Continued on page* 147)

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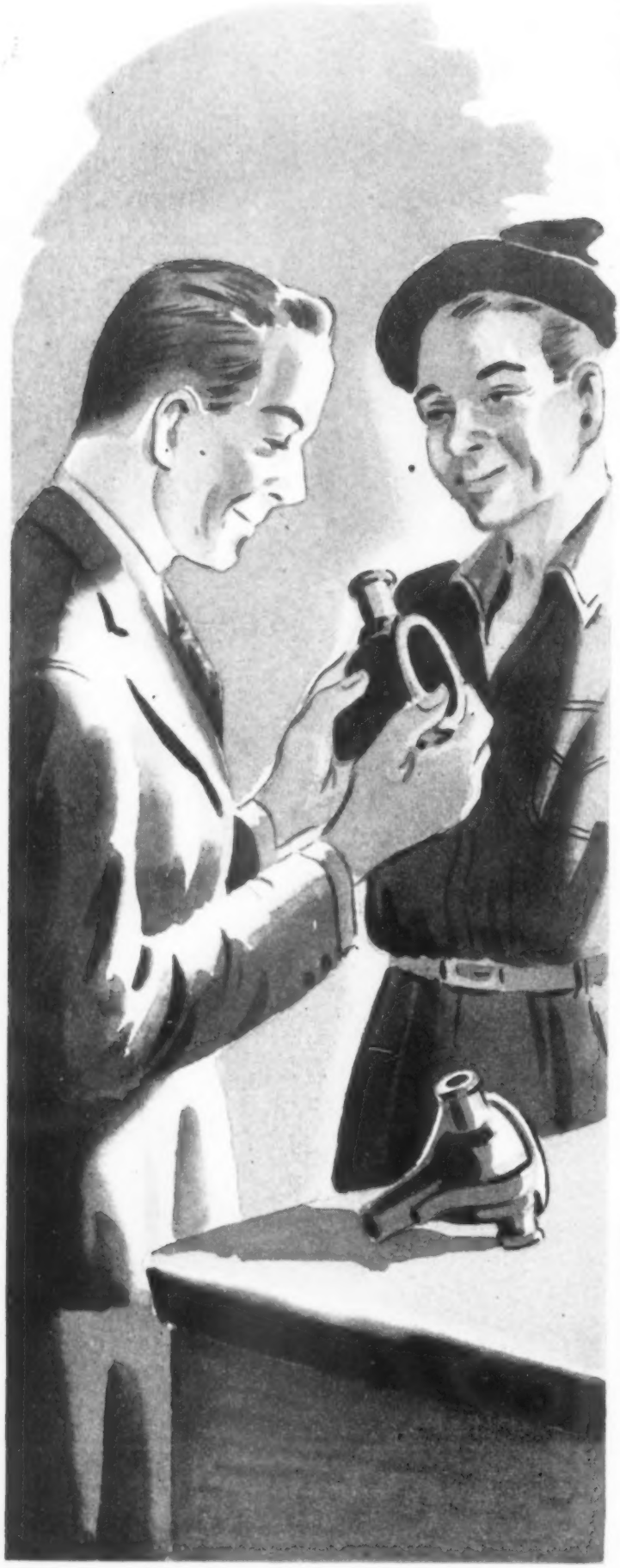

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(*Continued from page* 144)

reduces tensile strength about one-third, and elongation about one-half to two-thirds.

Silicon usually is maintained as high as consistent with obtaining white castings to increase annealing rate and strength due to alloying properties. Attempts have been made to increase the effective amount of silicon without formation of primary graphite, and one example is the use of high silicon and small quantities of tellurium. Tellurium appears to insure whiteness in the casting without affecting annealing. However, the practice is not in commercial use as far as known. Other things being equal, faster cooling of a given composition results in greater tendency toward whiteness, and permits more rapid annealing. Superheating also increases whiteness and more rapid annealing.

Some plants have found it advantageous to shake the castings out while still white hot, which is said to result in easier breaking off of the sprue, and shortening of the annealing time. Type of melting unit has an effect on tendency toward whiteness. With same raw materials and carbon content, the tendency toward whiteness is least in the cupola, and greatest in the induction furnace. Late additions of steel to the furnace will reduce this tendency toward formation of primary graphite. Use of rusty scrap, iron oxide, or oxidation of the iron will have the same effect, but may result in shrink or gas holes. Prof. Schneidewind mentioned a special type of pearlitic malleable which was quite wear resistant when used as a brake drum. Alloys were used, and the metallographic structure showed temper carbon, spheroidized pearlite, and massive carbide in isolated patches.

Use Brick on Furnace Bottom

Final session on malleable was held Friday afternoon with Joseph Kropka, Chain Belt Co., Milwaukee, in the chair. C. A. Brashares, Harbison-Walker Co., Pittsburgh, spoke on "Refractories for Malleable Furnace Bottoms". Application of brick bottoms to air furnaces is a development of the last decade, and the predominant types of brick used are either super-duty fireclay brick or the 60 per cent alumina type. He discussed compositions and properties to show that both types meet service requirements. Mr. Brashares showed motion pictures of methods of brick manufacture, and procedures employed in laying brick bottoms for good service. For cold charge furnaces the arch type of bottom may be employed to advantage, and while successful super-duty bottoms have been built, laying the brick directly on sand, general preference is to install a sub-bottom of 9-inch brick on end. Brick used for that purpose are high heat duty fireclay brick.

It is exceedingly difficult to state definitely what should be considered satisfactory refractory life for brick bottoms since conditions vary widely from plant to plant. As a general average 3500 to 6500 tons of metal may be melted on a cold charge and from 1800 to 4500 tons on duplexing. It appears that no greater number of heats are obtained by reducing the tonnage per heat so that it is much better to secure a high tonnage per bottom by running a large tonnage per heat.

Opening session of four on nonferrous foundry methods and problems was held at 2 o'clock on Thursday under the direction of Ben D. Claffey, General Malleable Corp., Milwaukee. J. C. Helm, National Bronze & Aluminum Co., Cleveland, spoke on "Production of Aluminum Aircraft Castings", describing briefly the procedures employed in his plant. All sands used for molding and cores are checked for grain size and other properties, and after being placed in use, regular routine tests are performed to see that they meet the standards set up for strength, moisture, permeability, etc. No sand handling system is employed, but after the molds are shaken out the sand is run through sand conditioners before re-use. To insure sufficient cool sand for covering patterns a facing sand is employed.

Use Special Gates

Methods of gating and risering vary according to the type of casting, but extensive use is made of slotted type gates and strainer cores to insure clean metal entering the cavity. Close control is maintained on the metal employed for aircraft castings. Each car of ingot received is rechecked for composition, and specimens are x-rayed to see that the metal is free from excessive oxides or porosity. Gates and feeders removed from castings are melted and cast into ingot before re-use. Melting operations are kept under close control, and the castings are poured under temperature control. Several test bars are made with each heat, and they are subjected to the same heat treatment as the castings.

In cleaning, the cores are removed with vibrating tables and vibrating hammers. Gates and risers are removed with band saws, but in the case of some larger types of castings high speed tungsten carbide tipped saws mounted on old planers and milling machines are used. After hand rotary grinding operations, the castings are abrasive blasted, and then pressure tested. The castings are heat treated or normalized as the case may require, and then checked and straightened. They are pressure tested again to insure that no leaks have developed, and then checked on target fixtures for dimensional accuracy.

Second nonferrous session held Thursday afternoon was devoted to inspection. Walter Edens, Ampco Metal Inc., Milwaukee, was chairman, and W. H. Baker, Aircraft Division, Packard Motor Co., Detroit, and E. J. Foley, Supercharger Plant, Allis-Chalmers Mfg. Co., Milwaukee, were the speakers. Mr. Baker talked on shop inspection, and mentioned the large force required to carry on the work of inspecting parts entering into the Rolls-Royce aircraft, and Packard marine engines. At present the inspection force consists of 4200 or in the ratio of 1 inspector to 4 workers in the plant. Mr. Baker mentioned that in 1943 his plant had produced 19,000 aircraft, and 8500 marine engines with a total horsepower of 40,000,000. Immensity of inspection may be seen by the fact that 15,000 different parts are used.

New castings as well as samples taken during the week's production are subjected to careful tests to see how they check with engineering drawings. After machining they are sectioned at specific points so that the thickness can be determined. In routine inspection the castings are numbered, and test bars from the same heat are subjected to physical property determinations. The castings are inspected closely both externally and internally to see that they meet specifications. Narrow internal passages are examined with an instrument similar to the surgical cystoscope which consists of a small electric lamp about the size of a grain of wheat and magnifying reflecting prisms. Flashlights and dental mirrors also are used for interior examinations. Measurements are taken with transfer and indicating calipers. Areas are checked for porosity by chalk test and under black light with fluorescent oil. Castings also are target checked for dimensional accuracy.

Receive Rigid Inspection

Mr. Foley discussed the laboratory inspection of aircraft castings including aluminum alloy and high temperature resistant alloys of the stellite type. In general checking of the aluminum consists in chemical and physical tests. Supplementary tests include x-raying and fluorescent examination under black light. Existence of a ground surface causes trouble with black light examination since grinding smears the surface so that oil cannot penetrate the crack. Use of a caustic etch is found advantageous. In x-ray technique use of a 2-film procedure has given good results. A fast film and a relatively slow film are employed to differentiate between heavy and light sections where the difference is not too great.

Stellite type castings are given room temperature tests for quality, and high temperature tests for short and long periods. Long high temperature tests are carried out at the temperature at which the castings will operate in service, and give a true indication of the load that the part will actually stand in operation. In addition to those the castings are subjected to stringent x-ray examination due to severe operation requirements. Considerable work has been done to correlate x-ray indications and those obtained by sectioning and other tests.

Third session on nonferrous castings comprised a clinic on gates and risers and scrap, with H. M. St. John, Crane Co., Chicago, as speaker and H. E. Bremer, H. E. Bremer Mfg. Co., Milwaukee, as chairman. Mr. St. John pointed out that gating and risering a casting depended upon a number of factors, such as critical sections with

respect to pressure tests or perfection of machined surface, fluidity of the metal, pouring temperature and speed of pouring, whether strainer cores or choke gates will be used, layout of pattern plate, etc. For best results the mold should be designed with respect to position of the castings, location and size of gates and risers, number of pieces on pattern plate, hydraulic head, and use of strainer core or choke gate. Attempt should be made to control the quality of the metal at a level that can be maintained uniformly.

If fluidity of metal varies, gating requirements also should vary. To compensate for varying quality of metal, the pouring temperature should be changed accordingly; change in number of molds poured from a pot also may be made. Mr. St. John said that high zinc brasses can be poured at highest attainable temperature close to the boiling point. Red brass alloys usually are limited as to maximum pouring temperatures. Under ideal conditions of casting design a pouring range of 150 degrees Fahr. may be possible, but ordinarily the range is 100 degrees. In some cases the pouring temperature range is quite limited, and extreme care must be taken in design. He pointed out that for economical reasons gates and risers should be no larger than absolutely necessary.

Describe Sand Practice

Concluding session on nonferrous castings was held Friday afternoon with A. H. Schott, Standard Brass Works, Milwaukee, and L. J. Andres, Lawran Foundry Co., Milwaukee, as co-chairmen. A. W. Magnussen, Wright Aeronautical Co., Cincinnati, described some of the sand practices employed in aluminum and magnesium castings production. For magnesium Portage county sand is used with about 1 per cent boric acid and 1 per cent sulphur as inhibitors. The same kind of sand is used for cores. Moisture content is held as low as possible, and is about 3.5 to 4 per cent at the mixers, which drops to 2.5 to 3 per cent by the time it is used in the molds. Both western and southern bentonite are used. Green compression of the sand runs between 8 and 9 pounds per square inch. Due to the large number of chills which must be carried by sand used for magnesium, it must be fairly strong to eliminate use of arbors or other devices.

For aluminum cylinder heads a facing sand of 100 grain fineness with 7 per cent moisture, and bonded with oil is employed to cover the pattern face, and form the fins. The backing sand ranges from 50 to 85 grain fineness with 6 per cent moisture, and is bonded with oil and cereal. Dry or baked permeability of the molds varies from 60 to 90 while the internal cores have a permeability of 100 minimum. Mr. Magnusson stated that many of the cores used seemed harder than necessary, but that considerable rough handling was encountered. However, he hoped that the strength could be reduced gradually to a more reasonable point, say around 170 pounds per square inch.

Three sessions on management and engineering were devoted to applications of the spectograph, vibration mechanics of a combustion engine, and a symposium on centrifugal casting of metals. The first meeting was held Thursday morning with L. E. Royt, Allis-Chalmers Mfg. Co., Milwaukee, in the chair, and H. F. Kincaide, International Harvester Co., Rock Island, Ill., as the speaker. Mr. Kincaide said that for analyses of fabricated iron and steel a universal spectrographic technique is needed, and that requirement is fulfilled satisfactorily with a commercial grating spectrograph; using the flat-surface method of sampling. Mr. Kincaide described the installation in his plant and its operation. He discussed influence of length of preburn, humidity changes, size of sample, etc., on accuracy of spectrographic analysis.

Use Single Reference Line

Analytical procedure involves use of a single iron reference line for the quantitative determination of manganese, chromium, nickel, molybdenum, vanadium, copper, aluminum and silicon in steel. Similar technique is used for determination of silicon and manganese in gray iron foundry control work, and in testing of miscellaneous castings. Mr. Kincaide presented tables illustrating the lines used, excitation conditions, developing procedure, and accuracy to be expected in quantitative determinations of 5 elements on a single spectrogram.

An interesting session was devoted to centrifugal casting. A. K. Higgins, Allis-Chalmers Mfg. Co., Milwaukee, was chairman, and was assisted by a panel of experts including Walter Edens, Ampco Metal Inc., Milwaukee; H. F. Taylor, Naval Research Laboratory, Washington; John Putchinski, Allis-Chalmers Mfg. Co., Milwaukee; Paul Power, Maynard Electric Steel Casting Co., Milwaukee, and George Dreher, Ampco Metal Inc. In the discussion distinction was made between two general types of operation, as exemplified by spinning of tubular types revolving on the axis of rotation, and that in which a number of castings are located around the central or pouring axis.

Mr. Edens listed as principal advantages of centrifugal castings the elimination of centerline weakness, increased density of metal, and smaller grain size. He claimed that an increase of 10 to 15 per cent in physical properties can be obtained with slight if any reduction in ductility. Also metal can be poured at lower temperatures, and thinner sections can be obtained regularly. Mr. Taylor in discussing centrifugal casting as applied to steel said that centerline weakness is not eliminated in light section castings due to quick freezing. In heavy castings it is eliminated as in the case of nonferrous castings. Mr. Taylor mentioned the success obtained in casting hollow steel shafts 14 or 15 inches in diameter and 20 feet long. He also talked about the new precision casting procedure using special refractory molding materials. So far the practice is limited to small castings which are produced to tolerances of 0.001-inch, and no machining is required. Plastic and wax patterns are used which disappear when the mold is baked.

Mr. Putchinski described centrifugal casting from the shop point of view, pointing out the limitations due to shape and size. One advantage is saving of floor space, and he stated that while initial cost for centrifugal casting is high, operating savings in increased yield and decrease in machining costs more than offset the initial cost. Mr. Power showed slides of numerous steel castings made by the process and described the practice employed at his plant.

George Dreher discussed centrifugal casting from the safety point of view describing the hazards involved, and the safeguards which must be employed. Every precaution should be exerted to insure safe operating conditions.

Problems of present day melting were discussed by H. K. Sohner, International Harvester Co., at the opening gray iron session presided over by Frank Waldenmeyer and co-chairman E. Janke. Following a brief resume of the melting problems in jobbing and production foundries, the speaker explained that his paper was confined to procedure as observed in the production type foundry with which he is connected. He followed through a complete cycle of operation of a cupola including preparation, burning-in of the bed, method of charging, sequence of materials, effects of proper and improper charging methods, and particularly stressed the necessity of maintaining a uniform diameter in the lining. Where a base mixture is melted, suitable for several classes of castings, ladle additions of alloys change the composition to suit the other lines of castings.

Stress Importance of Detail

He claimed that probably the most important operation to insure satisfactory results throughout the heat is the proper burning-in of the bed. Rigid rules of procedure must be set up and maintained. Changes should be made only by the metallurgist in charge. The proper bed height should be established through the intelligent application of available technical data and experience gained in operating the cupola to suit the particular needs of individual foundries. Tendency toward bridging is less pronounced in continuous melting and tapping, than where the cupola is operated intermittently. When tapping continuously, the balance between size of tap hole and slag hole and automatic regulation of the blast must be maintained. The paper was based on the practice in a foundry where two out of three cupolas are in operation daily for 9 or 10 hours.

Prof. M. O. Withey, college of engineering, University of Wisconsin, presented a paper on the significance and importance of physical testing and the interpretation of the results. The talk

(*Concluded on page* 150)

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(*Concluded from page* 148)
was confined to a discussion of the more important tests for cast iron with supplementary remarks concerning the accuracy of apparatus, and the selection and preparation of specimens. He claimed that for most mechanical tests an accuracy of 1 per cent in the readings of the load or stress is sufficient. Dimensions and strains or deflections should be determined with sufficient precision to insure the desired accuracy.

The speaker pointed out that for comparing mechanical properties of two materials, the size, shape, method of fabrication and subsequent treatment of the specimens should be standardized. For research purposes one or more of these may be made a variable. The inspector always must bear in mind that test results are of little value unless specimens truly represent conditions and range of properties under investigation. No particular of the testing program is more important than correct sampling. In materials like gray iron, the effect of method of loading, location of specimen, rate of cooling and shrinkage are factors worthy of careful consideration.

Use Transverse Bending Test

Of the specification tests now in common use, the transverse bending test can be made to yield the most information concerning the various mechanical properties of the iron. To develop its maximum usefulness, deflection measurements at least at the maximum load should be required. The tension test probably is second in value from the standpoint of information of a general nature regarding quality of iron tested. Both are destructive tests. The brinell hardness test, when properly applied, will serve as an index of the quality of the iron so far as can be determined from indentation tests made upon the surface of the specimen. It correlates well with most of the other mechanical properties.

A. S. Klopf, Hansell-Elcock Co., Chicago served as chairman at a general scrap clinic, while George Zabel, Universal Foundry Co., and Charles Zahn, Vilter Mfg. Co., led the discussion based upon a report issued, by the A.F.A. listing every conceivable form of casting defect, the causes and the preventive or remedial measures. The list is so formidable that one is moved to wonder that any castings come through the ordeal successfully.

To facilitate presentation the speaker read a brief description of each item, nature of defect and causes and then invited discussion from the floor. The first, blows, gas holes, pin holes and blisters is typical of the others. Blows or gas holes usually are rounded cavities and may be spherical, flattened or elongated. They are caused by the generation and/or accumulation of gas which does not escape either through the sand or the metal. They may vary in size from a minute cavity upward. The walls vary in color from dark blue to a silvery metallic luster. True blowholes caused by trapped bubbles of gas in the metal rarely appear on the drag surface of a casting. They may appear as a smooth depression on the outside surfaces of the cope or side, or as a series of jagged, irregular depressions on the cope, especially on flat spots. Porosity, slush and dirt caused by steam or gas passing through the metal with resulting disturbance and the consequent combination of dirt or dross (mold slag) or shrink or dendritic area is a form of blow. Core blows generally show on the inner surfaces of a cored cavity or in the wall above a cored cavity. Blows caused by chills, chaplets or wires are found as one or more pockets adjacent to these inserts.

A portion of the casting, or sometimes the entire surface of a casting may be pitted with small holes about the size of a pin point. A blister is a shallow blow on the surface of the casting with a thin film of iron over it.

At the final session on gray iron K. R. Geist, Allis-Chalmers Mfg. Co., in a paper entitled "Effect of The Carbon Equivalent on Section and Physical Properties", stated that the controlling section size in a casting is the deciding factor in determining the type of iron to use. All tests mentioned in the paper were made on gray cast irons from actual production runs in the foundry. No chilled or alloy irons were used. Test bars were cast in 8 sizes varying from ¼ to 6 inches in cross section and each 10 inches long. They were cast in green sand molds made from the regular run of heap sand. Bars were cooled over night and taken to the laboratory next morning. He pointed out that there are several ways to figure the carbon equivalent. The following formula was used: Carbon equivalent $TC+0.3(Si+P)$.

Less Sensitive to Cooling

Results obtained showed that irons with a low carbon equivalent are much less sensitive to cooling rates, especially in thin sections. Low carbon equivalent irons also are much more uniform in brinell hardness. In the thinner sections the gray irons tested showed fine pearlite and tendency toward dendritic carbon pattern, while the larger sections—over 3 inches—showed no dendrites, large carbon flakes and some free ferrite when iron with the same carbon equivalent was poured into each of the several test bars. It was also noted that for any given section size, both the tensile strength and the brinell hardness decreased as the carbon equivalent increased. However, as the carbon equivalent increases beyond 4.40 per cent there is but little difference in the tensile strength of bars taken from the various sections. Bars taken from the outer edge of the larger test pieces were higher in tensile strength than bars taken from the center, but they followed the same general curve when plotted against the carbon equivalent.

The higher strength irons showed little variation in tensile strength between bars cut from the outer edge and those taken from the center. The low carbon equivalent irons showed fine graphite, fine pearlite and a dendritic pattern. The high carbon equivalent irons showed coarse graphite particles, random distribution and some free ferrite. Machinability increased notably with increase in section size. Graphitizing ladle additions reduced the brinell hardness of chilled iron, but produced little effect when added to normal gray iron. All irons discussed in the paper were inoculated in the ladle according to standard practice in this foundry.

Old mix to produce a 50,000 pounds per square inch iron consisted of 80 per cent steel scrap, 10 per cent cast scrap and 10 per cent pig iron. This same quality iron is now produced from 35 per cent steel scrap, 45 per cent cast scrap and 20 per cent pig iron. It has been found that a gray iron with uniform physical properties can be produced if the carbon equivalent is held constant and the metal melted hot, regardless of the type, of mix in the cupola. Method of tapping the cupola will influence the carbon equivalent. Long taps will result in higher carbon equivalent and lower strength.

The carbon equivalent can be controlled at will by varying the makeup of the charge or changing cupola practice. The low carbon equivalent will be affected most quickly. All scrap mixtures give the same carbon equivalent and tensile strength as obtained from a 40 per cent pig iron mixture. The cooling rate affects properties of the iron. An iron with a carbon equivalent from 4.00 to 4.10 showed 229 brinell when shaken out after 10 minutes, 224 after 30 minutes, 216 at 50 minutes and only 171 when allowed to cool to room temperature in the mold.

Test results from bars taken from production jobs in the shop fell right into the zones indicated by the graphs shown in connection with the paper. All scrap at the Allis-Chalmers shops is produced on the plant. Analysis of irons used in the tests showed 0.17 per cent nickel, 0.10 per cent chromium present as residual alloys. All carbon equivalents were figured from the analysis of the iron in the as cast condition.

Because of the large number of technical sessions held during the Wisconsin foundry conference, it will be necessary to defer publication of the reports on a number of the sessions until the April issue.

THE EDITORS

Malleable Production

Malleable iron castings production in December totaled 75,188 tons, compared with 72,077 tons in November, 66,177 tons in December, 1942, and 71,311 tons in December, 1941, according to reports to the Department of Commerce. December orders booked, less cancellations, amounted to 81,978 tons, against 93,370 in November. Output for all of 1943 was 849,764 tons, compared with 768,496 tons in 1942 and 843,038 in 1941. Reporting plants represent about 93 per cent of the industry's capacity.

No More Core Troubles Here

The cores pictured, made in a Michigan foundry producing armament and pump castings from a wide diversity of patterns, are "Certified" cores. Making cores to required standards has ceased to be a problem in this shop since Certified core oils were adopted. These dependable and economical core oils assure cores of maximum strength with minimum baking time and easy shake-out. Gummed-up boxes, excessive mold gas and noxious odors are troubles of the past.

Many foundries on war production have profited by employing the gratis service of our laboratory for suggestions on reducing core costs and eliminating core production troubles.

For every type of casting—ferrous or non-ferrous—there is a correct grade of Certified core oil. A mixed-by-weight oil that will definitely enable you to make full strength cores with firm edges, that assures smooth working in the boxes, reduced baking time, core breakage and cleaning costs.

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New Jersey

CORES, core binders and core washes were discussed by J. A. Gitzen, president, Delta Oil Products Co., Milwaukee, before 150 members and guests of the New Jersey Foundrymen's Association at a dinner meeting at the Newark Athletic Club, Tuesday, Jan. 25. The speaker described various types of core binders and washes and outlined some of the more recent developments in bonding materials and their applicati m.

John L. Carter, cost consultant, Gray Iron Founders Society, Washington, said that as a result of various appeals from gray iron foundrymen for modification of Maximum Price Regulation 244, the Office of Price Administration is sending questionnaires to 300 out of 1800 gray iron foundries throughout the country by way of investigating necessity for change.

Mr. Gitzen, in his discussion of core binders, emphasized the importance of keeping down the water content of the core. Some of the greatest failures in foundry procedure, he declared, can be attributed to unbaked cores, which in turn can often be ascribed to too much water in the mixture originally. He thought 3½ per cent water was generally ample and that in most cases 3 per cent would be more satisfactory. Much time and heat can be saved in keeping down the water content.

Moreover, he said it is not necessary to add an excess amount of water to provide special hardness. A foundryman, he said, can get all the hardness he can ever expect to obtain from water if he does not go beyond 2½ to 3 per cent. Limitation in the use of water to not more than 3 or 3½ per cent will provide a casting with a better and smoother surface. Incidentally, he outlined a procedure for testing cores so as to ascertain whether they have been sufficiently baked.

Commenting on various types of oils, he said that under present wartime limitations on fish oil, linseed is now about the only drying oil left. He discussed various cereals and their applications and also pitch binders, and said that these and all organic binders decompose under heat and are often destroyed before the core is reached by the metal. Consequently, it is important to include the use of inorganic binders, as they do not burn up readily. There are three series of inorganic binders, he said, namely, clays, iron oxide base materials and silica flour.

Mr. Gitzen spoke on use of iron oxide in cores, asserting it is proving highly successful in checking veining. He suggested when it fails to do so satisfactorily, bentonite or some similar element should be added.

He commented briefly on core washes and pointed out what materials and procedure should be used to provide adequate waterproofing and hot strength. The core wash, he added, must have an affinity for the oil in the core for best results. He warned foundrymen not to rely on air drying of core washes. He referred to spray binders as something often used to speed up production—*B. K. Price*

Detroit

LARGEST turnout of any regular monthly meeting in the history of the Detroit chapter was on hand for the Jan. 20 meeting at the Rackham Memorial, 205 being served at dinner, and 15 more participating in the meeting afterward.

Ralph L. Lee of General Motors Corp. presented a sparkling address on "Leadership and What It Takes" in which he took apart the characteristics of industrial leaders to see which were good and which were bad. This was the second appearance of "Doc" Lee before the chapter, and his enthusiastic and amusing presentation kept the entire crowd alternating between laughter and applause.

M. J. Gregory of Caterpillar Tractor Co. reviewed the subject of coreblowing and presented an unusually complete exhibit of blown cores, coreboxes and related materials. His assistant, Z. Madacey, answered questions from the floor on details of the coreblowing technique at the Caterpillar plant.

Mr. Gregory's address was accompanied by a number of slides showing the equipment in use, and as a concluding feature he presented a short moving picture of the aluminum cylinder head foundry operated by Caterpillar, and staffed 85 per cent with women.

The usual round-table discussions were suspended for the January meeting, in the interests of having everyone hear Mr. Gregory's comments, but in February the usual four simultaneous roundtables were to be resumed.—*A. H. Allen, secretary.*

Canton-Massillon

NEARLY 60 foundrymen in the Canton-Massillon district of Ohio met at the Elk's Club, Canton, O. on Jan. 27 to consider the organization of a chapter of the A.F.A.

Karl F. Schmidt, United Engineering & Foundry Co., Canton, chairman of the meeting, spoke briefly on events leading to the gathering, and introduced Norman F. Hindle, assistant secretary, American Foundrymen's Association, Chicago. Mr. Hindle gave a short history of the association, and described its activities, benefits to be derived from membership, and the part that chapters play in its functioning. Mr. Schmidt then introduced William B. Wallis, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, and a national director of the A.F.A., who congratulated those present on the good turnout, and spoke on the advantages of A.F.A. membership. Following those remarks I. M. Emery, Massillon Steel Casting Co., Massillon, O., moved that the group petition the national office for a charter chapter. This was seconded by H. G. Robertson, American Steel Foundries, Alliance, O., and carried.

Fred J. Walls, International Nickel Co. Inc., Detroit, and vice president-elect of the A.F.A., addressed the group at the technical session which followed, and discussed future trends in the foundry industry. He pointed out that castings always will hold a prominent place, but that to insure pre-eminence, foundrymen must carry on research and do a good marketing job. Further, the industry should bring attention of the foundries to boys and instructors in high schools, informing them not only of the value of castings, but also the opportunities available in foundry work.

Mr. Walls stated that the investment process of casting offered the industry a chance to expand its field by producing precision castings. Producing castings under a vacuum also provides additional opportunity. Use of centrifugal casting

(*Continued on page* 154)

BALANCED TEAMWORK

Shooting the straightaways—banking the turns—streaking down the icy mountain-side like greased lightning takes teamwork. It's teamwork, too, that turns out profitable castings.

MOGUL CEREAL BINDER . . . *saves binder costs;* reduces baking time and cleaning costs; increases oven capacity and core production . . . PRODUCES QUALITY CASTINGS.

MOGUL is a perfect Green Bond, which increases permeability in cores and bonds. MOGUL can be used in cores when both green and dry strengths are required.

MOGUL works with core oil, because it decreases drying time, and produces smooth cores. MOGUL works perfectly with pitch or resin, too, because cores can be handled while still warm. MOGUL is widely used with sharp sand.

Team up with Mogul Cereal Binder. It's the WINNING COMBINATION

KORDEK

Kordek is a perfect DRY BOND. Kordek can be used in smaller proportions than most dry binders. Produces better castings with fewer discards.

CORN PRODUCTS SALES CO.

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(*Continued from page* 152)
process where it could be applied was still another way of advancing the casting industry. Mr. Walls said he believed that the surface was just now being scratched, and that new developments in the offing will be of great benefit in furthering the application of castings.—*Edwin Bremer.*

Michiana

THE Jan. 4 meeting of the Michiana Chapter of the A. F. A. held at the LaSalle Hotel, South Bend, was devoted to the discussion of one phase of costs applicable to industry as a whole—labor cost. This subject was presented by J. Wittner, Oliver Farm Equipment Co., South Bend, under the title of "Job Evaluation".

Mr. Wittner defined job evaluation as a device of pool judgment set up on a comparable basis, scientifically establishing all known values and variables and providing for mutual participation of management and employe. The mutual participation leads to good labor relations which, in turn, means sound wage policy. Mr. Wittner then presented charts showing how to evaluate each individual job. These charts, set up on the basis of the men, material, and conditions to make up a job, were elaborated further by giving examples of job factors and weights which first must be established. The next chart showed the method of converting the point values to labor rates and the establishment of a base line rate from the lowest paid job to the highest.

Mr. Wittner's effective discussion of the subject attracted considerable interest from the 70 members present. It is the opinion of the chapter that subjects of this type should be included in the regular curriculum in chapter meetings because of labor shortages and continuous requests for adjustment of rates.—*V. S. Spears.*

St. Louis

COMPRESSED Air, Its Troubles and Remedies" was the subject for discussion at the Jan. 13 meeting of the St. Louis Chapter of the A. F. A. The meeting held at the DeSoto Hotel, was presided over by Luther A. Kleber, chapter chairman, who, after hearing the reports of several committees, read an open invitation extended by the American Society for Metals and the American Welding Society to attend any of their meetings. It was agreed to hold a joint meeting with both of these societies when arrangements could be made.

Mr. Kleber then introduced the speaker, James A. Murphy, of the James A. Murphy Co., Hamilton, O. Mr. Murphy's illustrated talk on problems relating to use of compressed air in foundries was well received and stimulated considerable discussion.—*John H. Williamson.*

Rochester

ROCHESTER Chapter of the A.F.A. had its second meeting in the Hotel Seneca, Feb. 5, with an unusually large attendance of approximately 250. This was a joint meeting of the Buffalo and Rochester Chapters, and in addition to representatives of these two cities guests were present from Syracuse, Seneca Falls, Geneva, Dunkirk, Lockport, Niagara Falls and Painted Post.

Samuel Dicker, mayor, and Frank E. Van Lare, vice mayor of Rochester accepted the chapter's invitation to attend the meeting. The mayor spoke briefly to the group, expressing his thanks for the opportunity to greet this new chapter, and commending the foundry industry for the excellent work being done in the war effort.

Frank Bates, chairman of the Western New York Chapter of the A.F.A., extended an invitation to attend the forthcoming Third War Production Foundry Congress to be held in Buffalo in April. Charles Vaughn, vice president of the Rochester Chapter, introduced those at the speaker's table, which group included H. B. Hanley, president of the chapter, who presided, Mayor Dicker and Vice Mayor Van Lare, William J. Conley, the speaker of the evening, Frank Bates, chairman of the Western New York Chapter, Herman Hetzler, a director of the Rochester Chapter, E. E. Hook, treasurer of Central New York Chapter, W. D. Dunn, of the Syracuse Chapter, Donald Webster, secretary-treasurer of the Rochester group, and Walter Morton, program and publicity chairman.

Speaker of the evening was William J. Conley, former chairman of the department of engineering at the University of Rochester, now technical director of the Lincoln Electric Co., Cleveland, who spoke on "Foundry Variables." He stated that the present high standards of foundry production have been brought about by a more universal co-operation between foundrymen, engineers, metallurgists and management. As a result, proper metal control and a more suitable casting design is being employed now by virtually all the nation's foundries to produce a high degree of uniformity with a resulting reduction in defective castings.

Foundry variables, he feels, may be grouped under four headings: Thermal, chemical, mechanical and metallurgical. Closer attention to these features during recent months has contributed largely toward eliminating many defects, furnishing better quality castings, and increasing the yield of saleable castings. The method of introducing the metal into the mold, the design of gates and risers, chemistry of the metal, influence of the melting practice, composition of the charge, and ladle additions, all have an effect on the final product, and are features that must be considered carefully in the best of practice.

He demonstrated how the effect of proper gating, risering and particularly close control of pouring temperatures helped to lower the casting losses. Slides showing the dendritic structures of various ferrous and nonferrous alloys were shown to illustrate his point.

This very interesting and informative talk was followed by a general social get-together and excellent floor show.

The next meeting is scheduled for March 8, at the River Campus of the University of Rochester, with dinner at the Rush Rhees cafeteria, and the business meeting at the Geology Building. At that meeting Charles Vaughn, of the Ritter Company, Rochester, will speak on "Nonferrous Foundry Practice."—*D. E. Webster, secretary-treasurer.*

Quad-City

ANNUAL joint meeting of the Quad City Chapters of the A.F.A. and the American Society for Metals was held at Hotel Fort Armstrong, Rock Island, Ill., Jan. 17. About 110 members and guests were present. W. E. Jones, chairman of the A.F.A. chapter, presided.

A chicken dinner, followed by a half-hour musical program, preceded the technical session at which V. A. Crosby, Climax Molybdenum Co., Detroit was the featured speaker. In developing his topic, "Factors Affecting Properties of Cast Iron," Mr. Crosby stressed the constitutional makeup of the material, the importance of raw materials, and the effect of thermal treatment of the liquid metal.

It was the speaker's opinion that present-day ideas on high test and high strength irons will have to be revised soon to establish a minimum of 45,000 pounds tensile for this classification. The graphite pattern and alloying elements were discussed, and the necessity of proper polishing technique was stressed.

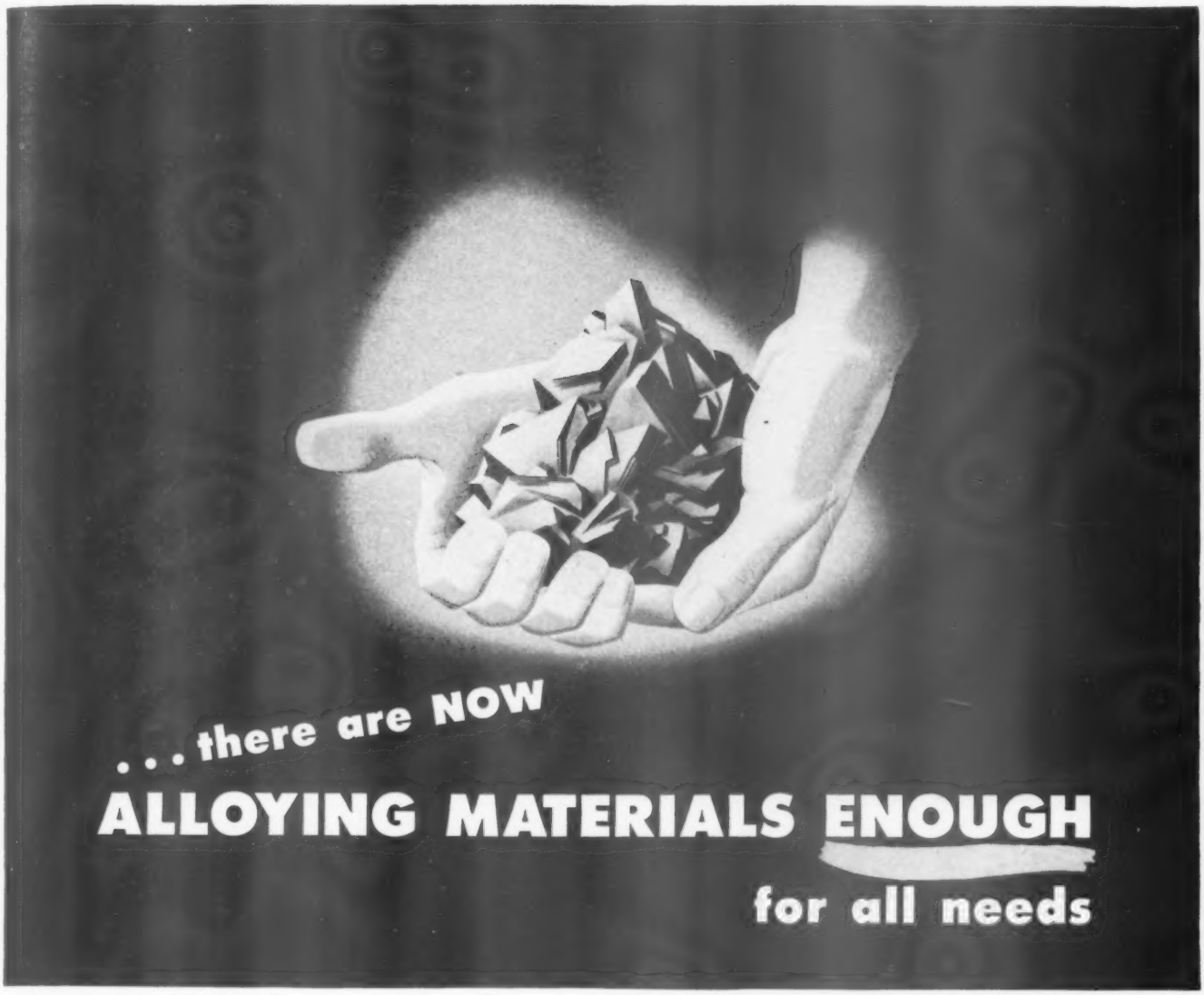
H. Bornstein, Deere & Co., Moline, Ill., acted as technical chairman during the discussion period.—*H. L. Creps, secretary-treasurer.*

Pittsburgh

LADLE inoculation and its effects formed the basis of an interesting discussion at the January meeting of the Pittsburgh Foundrymens Association. Tom E. Barlow, foundry engineer, Vanadium Corp. of America, Detroit, covered the subject thoroughly.

Discussing the two general types of inoculants, the speaker outlined what each accomplishes and why, and showed how addition of such inoculants improves uniformity in physical properties of castings. Control of variables in the melt, which is most difficult when a large percentage of scrap is used, can be accomplished easily through uniform melting procedure plus uniform use of inoculants, according to Mr. Barlow. The speaker also outlined the mechanics of adding the materials in the ladle, and described the procedure followed by certain found-

(*Continued on page* 156)



SHORTAGES of important metallurgical materials have now been either directly relieved or compensated by satisfactory alternatives.

Item: TUNGSTEN. Except for a few quite special uses, restriction is off. New production, greater volume of imports, and resulting growth of stock piles have brought relief.

Item: MOLYBDENUM. Crippling regulation is a thing of the past. Renewed availability of tungsten and other scarce materials, new Molybdenum production, and improved economy of alloying practice, have lessened the need of Government restriction.

Item: BORON. The potency of Boron as an intensifier of the effects of other alloying materials, has been the subject of almost incredible revelations in recent months. Very minute additions can be substituted for considerable percentages of scarcer and more costly elements, with full maintenance of the hardenability and other essential properties of high-grade steels. In cast irons, the percentage of Boron addition runs higher but is still very low and the results are remarkable.

The problem of an economical and satisfactory form in which to introduce Boron is met by a special ferro-boron produced by the Molybdenum Corporation.

As to the availability or approved uses of Tungsten, Molybdenum, or Boron, correspondence is invited.

AMERICAN Production, American Distribution, American Control—Completely Integrated.

Offices: Pittsburgh, New York, Chicago, Detroit, Los Angeles, San Francisco, Seattle.

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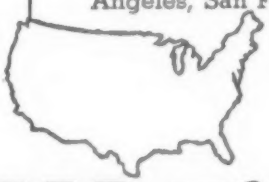

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(*Continued from page* 154)

ries in use of inoculants with good results.

E. C. Buerkle, association president, acted as chairman of the meeting, and F. G. Schultz, secretary-treasurer, presented a report on the annual Christmas party which was attended by 940 members and guests.—*R. L. Hartford.*

New England

FORTY-EIGHTH annual meeting of the New England Foundrymen's Association, held at the Hotel Gardner, Boston, Jan. 12, attracted about 300 members and guests. A special dinner was served, followed by the annual reports and election of officers for 1944.

New officers of the association include: President, T. C. Weiser, Griffin Wheel Co., Chelsea, Mass.; vice president, M. A. Hosmer, Hunt-Spiller Mfg. Corp., South Boston, Mass.; treasurer, Arthur W. Gibby, East Boston, Mass.; secretary, Ernest F. Stockwell, Barbour-Stockwell Co., Cambridge, Mass.

Members of the executive committee are: Mr. Hosmer; B. W. Hagerman, Rice-Barton Corp., Worcester, Mass.; D. L. Parker, General Electric Co., Lynn, Mass.; Arthur F. Dockey, H. & B. American Machine Co., Pawtucket, R. I.; Frederick M. Fitzgerald, Draper Corp., Hopedale, Mass., and Charles A. Reed, Rogers-Brown-Lavino Co., Cambridge, Mass.

After a brief address of welcome by the new president, Mr. Weiser, the meeting was turned over to the entertainment committee, and the remainder of the evening was devoted to a program of special entertainment.

Regular monthly meeting of the New England Foundrymen's Association was held at the Engineer's Club, Boston, Feb. 9. About 90 members and guests were present to hear Guy H. Rhodes, safety supervisor, Foundry Division, Lynn & Everett Works, General Electric Co., speak on "Educating for Safety in Foundries."

Mr. Rhodes explained that one of the necessary requisites of good organized safety control in the foundry is the co-operation of all foremen. A well organized safety committee should consist of the shop superintendent, all foremen and all workmen who are interested in safety. Accidents increase costs, decrease production, and increase insurance rates.

The safety supervisor should be called in on many conferences of management. Modern machinery is designed for, and equipped against possibility of accidents. All foremen should co-operate in accident prevention by telling the men, showing the men, and explaining to the men, correct safety measures. The speaker said that in his plants all workers are given free eye examinations and fitted with correct glasses made according to prescription. The prescription may be filled by anyone at the discretion of the employe.

In places where noise is particularly bothersome, such as on the steel chipping floor, workers are provided with special approved ear protectors. Aspirators and safety shoes are used extensively. Hernia cases are especially troublesome, as it is almost impossible to determine where the trouble originated.

A new employe is obliged to sign a pledge to the effect that he will abide by all safety rules, wear all safety devices and aid in safety preventions to all fellow workers. Periodic safety inspections are made through the plant and notes made on bad practices and equipment. A second note on the same subject is not very well received by the manager.

Considerable comment was made on absenteeism in which the speaker told how he called at the home of regular offenders and talked to members of the family. He said that any time spent on checking these habitual absentees materially reduced the number of lost hours.

A lively and interesting discussion followed the address.—*Merton A. Hosmer.*

Philadelphia

ONE of the largest attendances in the history of the Philadelphia Chapter of the A.F.A. turned out for the Jan. 14 meeting to welcome and to listen to a talk on "Gates and Risers," by Pat Dwyer, engineering editor of THE FOUNDRY. B. H. Bartells, chapter chairman, presided, and Dr. G. H. Clamer, Ajax Metal Co., served as technical chairman and introduced the speaker.

Pat gave a very interesting and humorous talk, much of which was taken from his book "Gates and Risers for Castings," using a number of slides to illustrate various points. Considerable interest was shown in his remarks, which were followed by lively discussion.

As an after-dinner feature, two interesting motion pictures were shown, one of which is used for training purposes by the Army Air Forces. The other showed the present development and future possibilities of electronics. — *William S. Thomas, publicity chairman.*

E. Canada - Newfoundland

AN INTERESTING speaker in the person of J. Nixon, Whitehead Metal Products Co. Inc., featured the program of the Jan. 21 meeting of the Eastern Canada and Newfoundland Chapter of the A.F.A. at the Mount Royal Hotel, Montreal. His presentation of the subject "Molding Practice" consisted of a discussion of a series of attractive full-color slides of bronze castings in which satisfactory and unsatisfactory gating and feeding was shown. The intense interest of the audience of about 100 members and guests was evidenced by the numerous questions fired at the speaker during and following his talk.

At the director's meeting preceding the technical program it was unanimously approved that an apprentice competition be held in patternmaking and molding for gray iron, bronze and steel castings, with prizes awarded in each section. The contest will be held under the supervision of the apprentice committee whose energetic chairman is W. G. Burgess. Chapter membership was announced as totaling 244, only a few short of the season's objective of 250.—*A. E. Cartwright.*

Toledo

FIFTY-FIVE members and guests attended the Jan. 25 meeting of the Toledo Chapter of the A.F.A. Following the dinner an enthusiastic audience heard Fred G. Sefing, metallurgist, International Nickel Co., present a very interesting talk on "A Study of Methods for Sound Castings".

Mr. Sefing stated that in his opinion the success of any foundry, indeed of the foundry industry, hinges largely on its ability to make sound castings regularly. He recommended that records of successful methods for producing castings be kept and, if possible, photos showing riser, gates and chills with dimensions be attached to blueprints. A few of the points stressed were: Clean metal into mold, controlled directional freezing, correct design and pouring of risers to feed castings, proper use of chills, and adequate venting. Various questions asked Mr. Sefing contributed to the discussion, making this a most interesting meeting. — *R. B. Bunting, secretary.*

Reading

USE of refractory brick was discussed by J. A. Kayser, assistant vice president, Laclede-Christy Clay Products Co., St. Louis, before the Jan. 18 meeting of the Reading Foundrymen's Association. Hermann P. Good, president of the association, presided at the meeting, which was attended by about 70 members and guests.

Mr. Kayser pointed out that each furnace has an individuality of its own, and that while great advances have been made in the manufacture of refractory brick, the process still is not an exact science. Urging closer co-operation between refractory manufacturers and foundrymen, the speaker said that studies being made in the field by the manufacturers are vital to the progressive development of better refractory materials.

Mr. Kayser served on a joint committee representing 12 associations making a nationwide study of foundry refractories for the American Society for Testing Materials. He said that when called upon to determine the cause of trouble in a foundry, he feels much like the doctor who must make a diagnosis of a patient he has not seen before, and that while much is known about fire clays, experience and intuition contribute greatly toward making an analysis of the cause of trouble.

In describing the manufacture of fire clay brick Mr. Kayser said that they fall into three classifications: Stiff mud brick,

(*Continued on page* 158)

A Time-Saver for Your Plant— the SPO LAYOUT PROTRACTOR TABLE

● Save time and money and speed up production by installing a SPO No. 30 Layout Protractor Table. Its use simplifies the layout of patterns, core boxes and many other similar jobs. Lay out or check castings easily and accurately. Horizontal, inclined and vertical positions are quickly attained and rigidly held.

The rotary table is 30" diameter. The circumference is graduated from zero to 360 degrees by half degrees. The table can be locked in any radial position desired.

An adjustable arm, supporting an indicator and vernier, can be set to operate on either side of the table or in any intermediate position. All rotating parts are bearing-equipped for smooth running and long life.

Note: The unit, handling average weight work, can be moved to operate in any convenient position on any substantial surface plate.

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Horizontal position makes set-ups easy. Simply place work on table and bolt or clamp in any position desired.

Table can be locked in any inclined position. Quadrant is graduated in degrees, with vernier readings.

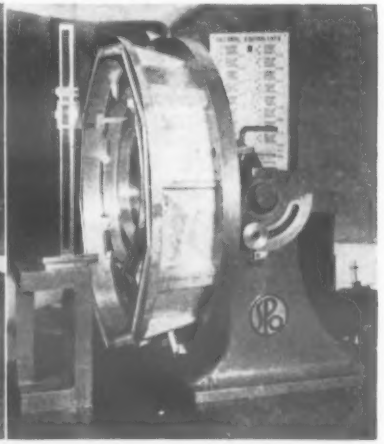

Table is tilted from vertical to horizontal position by means of a worm gear unit actuated by hand wheel.

● *These four photographs show the unit in actual operation in a modern, well equipped pattern shop. The SPO No. 30 Layout Protractor Table is a thoroughly tested product, fully worthy of your confidence. It carries SPO's usual guarantee of giving you complete satisfaction.*

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(*Concluded from page* 156)
resistant to abrasion and slag action; a power-pressed brick, relatively less strong but one that will withstand temperature changes better; and the hand-molded brick, which was the initial method of manufacture and which even today is used extensively.

Advocating the use of small units to counteract expansion and contraction, he said that many shapes are used in foundry work, and for reasons of economy the hand-molded brick often is more practical that those made in high-cost steel dies.—*H. C. Cummings, secretary.*

Western New York

ANNUAL stag party of the Western New York Chapter of the A. F. A., held at the Elks Club, Buffalo, Jan. 22, attracted an attendance of about 450 members and guests. A substantial buffet supper was followed by an extensive and varied program of musical and other entertainment. Responsible in large measure for the success of the affair was the committee in charge of arrangements, headed by Myron L. Doelman, National Engineering Co., as chairman, and Paul J. Bucheit, Electro Refractories & Alloys Corp., as vice chairman.—*W. G. Gude.*

Northeastern Ohio

TOM E. BARLOW, Vanadium Corp. of America, Detroit, presented an interesting discussion on inoculation of gray cast irons at the Jan. 13 meeting of the Northeastern Ohio Chapter of the A. F. A. Meeting was held at the Cleveland Club, Cleveland, and James G. Goldie, president of the chapter, presided at the dinner. Russell F. Lincoln, vice president, introduced the speaker. Mr. Barlow stated that use of small alloy additions in the ladle to improve the quality of castings appears to be growing in importance. The procedure more recently termed inoculation, permits control of structure day in and day out. However, inoculation cannot be expected to overcome careless operations; at all times the aim should be to obtain the highest quality iron from a given composition or mixture.

Often certain types of iron, particularly those of the high strength, low carbon class, tend toward a dendritic structure, and in those types inoculation will eliminate that tendency, producing a normal structure. In general two types of inoculants are available and called the graphitizing and stabilizing groups. The former contains such elements as silicon, titanium, calcium, etc., which act as graphitizers and deoxidizers. The stabilizing type contains such agents as chromium, silicon, manganese, etc. The graphitizing type inoculant usually is employed with the high strength, low carbon irons, and the stabilizing type with the soft grades of iron. In many cases a combination of graphitizing and stabilizing inoculants give better results than increasing the amount of one.

Since the effect of the inoculant wears off after a period of time ranging from 4½ to 35 minutes, most beneficial results are obtained by addition just before pouring. The amount of inoculant to be added will depend on the base composition of the iron, and the extent and type of improvement desired.

The annual Quiz Night program of the Northeastern Ohio Chapter held at Cleveland on Feb. 10 drew an attendance of well over 200, the largest of the year. Jim G. Goldie, president of the chapter, and foundry instructor, Cleveland Trade School, Cleveland, acted as quiz master and he had the following experts (Quiz Kids) to answer questions on every phase of foundry practice: G. C. Cole, plant superintendent, Forest City Foundries, Cleveland; W. C. Manwell, foundry superintendent, Fulton Foundry & Machine Co., Cleveland; Fred Pfarr, foundry superintendent, Lake City Malleable Co., Cleveland; Joe Scott, foundry superintendent, Central Brass Mfg. Co., Cleveland, and Ralph R. West, plant manager, West Steel Castings Co. Among the questions discussed were the following: Relative values of synthetic sands and molding sands; heat treatment of steel castings including definitions of full anneal, normalizing, liquid quenching and differential quenching; procedures in charging the cupola; methods employed to keep malleable castings from cracking, and methods of preventing white spots on yellow brass castings.

President Goldie announced that Ben D. Fuller, Whitehead Bros. Co., Cleveland, who is past president of the American Foundrymen's Association and an honorary life member of the A. F. A. and the Northeastern Ohio Chapter, was celebrating his eightieth birthday by attending the meeting. Mr. Fuller received the congratulations and best wishes of all in attendance. The president also announced that the chapter directors had voted to purchase War Bonds in the amount of $3000.00.—*Edwin Bremer, publicity chairman.*

Cincinnati

APPROXIMATELY 100 members and guests attended the Jan. 10 meeting of the Cincinnati Chapter of the A.F.A., and heard an interesting and instructive discussion by Fred G. Sefing, International Nickel Co., New York, on "A Study of Molding Methods for Sound Castings." Edward H. King, chapter chairman, presided.

Mr. Sefing pointed out that defective castings represent a double loss—loss of the casting and loss of the machining time and labor. He added that in the present emergency it is the duty of foundrymen to produce sound castings, and that in the postwar era it will be imperative to do so. Six important factors affecting the production of sound castings, applicable to all metals, were given as follows: Clean metal, controlled directional solidification, risers, correct use of chills, adequate venting, and carefully kept records.

Mr. Sefing discussed each factor in detail, illustrating his points with slides. Numerous questions from the floor attested to the fact this was one of the most successful technical meetings held by the chapter in a long time.

William A. Rengering, vice chairman, announced that L. P. Robinson, Werner C. Smith Co., Cleveland, would address the March 13 meeting. It also was announced that the chapter directors had voted to apply for affiliation with the Technical and Scientific Societies Council of Cincinnati.—*Martin F. Milligan, secretary.*

Western Michigan

FRED A. MELMOTH, vice president and works manager, Detroit Steel Castings Co., Detroit, was the principal speaker at the Jan. 10 meeting of the Western Michigan Chapter of the A.F.A., held at the Hotel Ferry, Grand Haven, Mich. About 70 members and guests attended.

The subject of Mr. Melmoth's talk was "Co-operation and the Human Equation in Foundries." He stressed the point that to further production in many foundries closer co-operation between men in supervisory capacity is necessary, adding that this closer co-operation would help to relieve what friction may exist between management and labor. Mr. Melmoth also indicated that to increase quality and production the foundry should seek to improve the attitude and ability of its personnel, from management down, and thereby automatically take care of many problems of production and quality of work.—*C. H. Cousineau, secretary.*

Chicago

IMAGINATION is the principal limiting factor in growth of the castings industry in the postwar period. Running a close second, is the need for more research. This was the appraisal made by J. H. Van Deventer, president and editor of *Iron Age* in addressing the Chicago Chapter of the A.F.A. on Feb. 7, on "The Future of the Castings Industry."

Mr. Van Deventer feels that in the field of heat treatment lies a good part of the answer to expansion of castings applications in the future. As compared with some other fields, the foundry industry has been to some extent backward. From the economic standpoint, the foundry industry is sadly delinquent in its cost accounting, the speaker asserted, there being a considerable lack of knowledge on actual production costs. Intensive study of this subject will produce beneficial results.

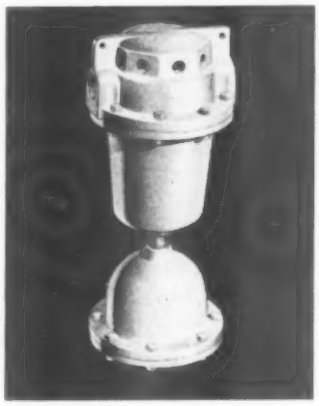
The chapter's next meeting March 6 at the Chicago Bar Association will feature the third roundtable program of the season. Subjects are announced as follows: Steel Division—"Gating, Risering and Pattern Rigging"; Gray Iron Division—"Controlled Solidification—Gating and Heading;" and Nonferrous Division—"Pressure Castings in the Brass Foundry."—*Erle F. Ross.*

Demountable Sheave

Allis-Chalmers Mfg. Co., Milwaukee 1, announces a new sheave, designed for quick and easy mounting and demounting, which locks to the shaft in one tightening operation. As the tapered split bushing is drawn farther into the sheave, the bushing, shaft and sheave are locked together simultaneously. Design of the sheave permits it to be mounted closer to the motor, thereby increasing bearing life by reducing shaft overhang.

Air Filter

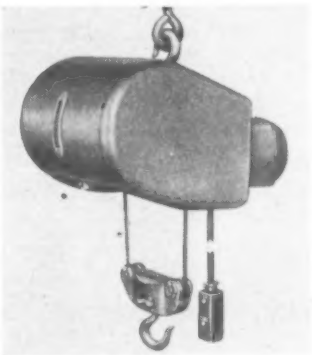
Filters Inc., Glendale, Calif., has added a new compressed air line filter to its products. The unit has six outlets in the manifold, and incorporates a self-



dumping trap which automatically empties the water filtered out of the lines. Outlets are ⅜-inch to accommodate snap-on hose connections. The closed float is said to guarantee positive opening and closing of the discharge valve. Interior parts are heavily plated to minimize rusting.

Electric Hoist

Conco Engineering Works, Mendota, Ill., is offering an improved electric hoist in 250, 500 and 1000-pound capacities. It incorporates double drum construction for balance. In addition to the standard hook type suspension, the hoist can be supplied with trolley or with lugs for bolt suspension. The unit is of simple construction, employing only two gear reductions, and is enclosed in a protective housing. Gear shafts are equipped



with ball bearings, and the worm shaft with roller bearings. An oil bath lubricates both gears and bearings. The limit switch is the single pole, paddle type, and operation is by push button control.

Unit Dust Collector

Pangborn Corp., Hagerstown, Md., is offering a new industrial type unit dust collector designed for smaller air volume dust control problems where a self-contained unit is indicated. It is made in three sizes having nominal capacities of 1000, 2000 and 3000 cubic feet per minute capacity, operated by exhauster

motors of 3, 5 and 7 horsepower, respectively. The unit consists of two major sections—a preliminary centrifugal section and a secondary cloth screen section. The bulk of entrained material is separated from the air stream in the centrifugal section, the fine dust being filtered out after flowing upward to the secondary cloth screen section. A shaking device frees the cloth surfaces from collected fine dust. All collected dust is deposited in a common dust drawer for removal and disposal.

Goggle Cleaner

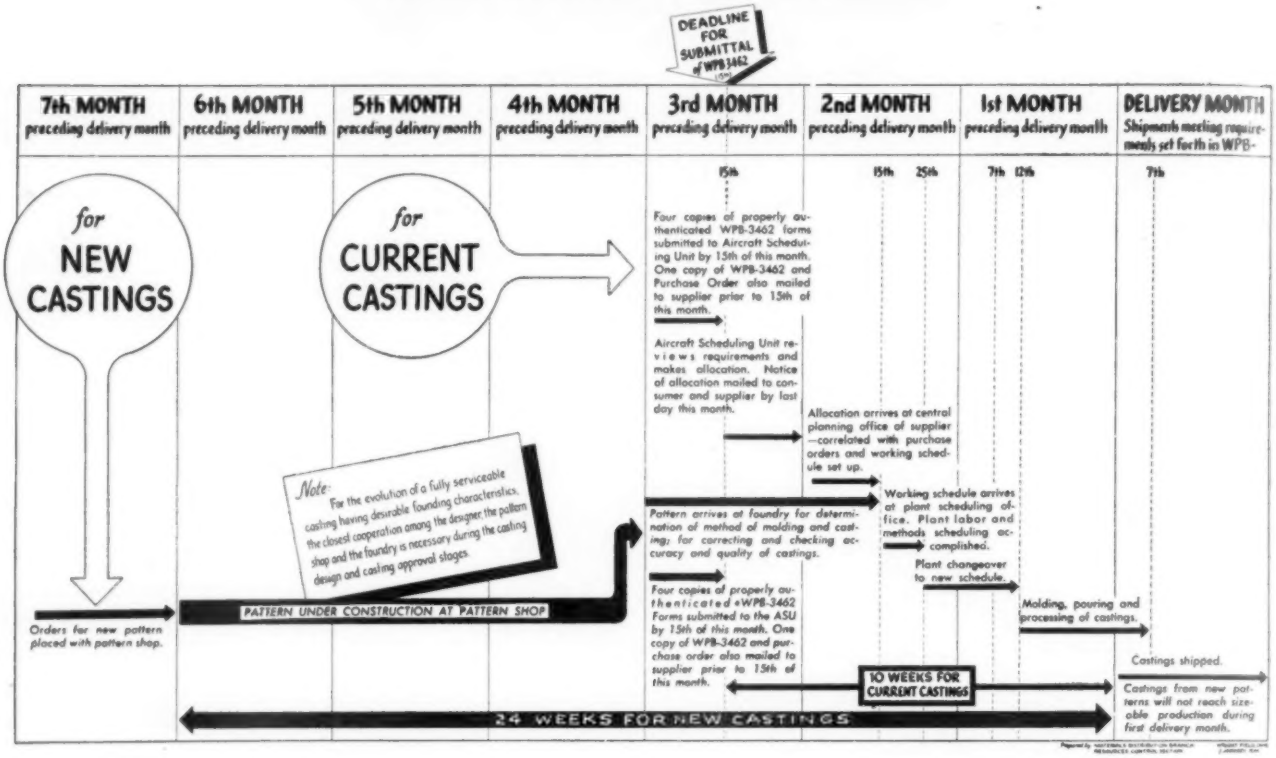
Mine Safety Appliances Co., Braddock, Thomas and Meade Streets, Pittsburgh 8, has developed a new goggle cleaning cabinet intended to encourage workmen to wear their goggles and keep them clean. The cabinet is equipped with two vials of a lens cleaning and

anti-fogging agent, which is sprayed on the lens when either button of the dispenser is tapped. The vials are concealed within the dispensing block, and the latter is provided with attachment for a padlock to prevent theft of the vials and other supplies. Two pairs of goggles can be cleaned at one time. Cleaning tissues are withdrawn from an opening in the top of the station.

Dressing Tool

Calder Mfg. Co., 628 North Prince Street, Lancaster, Pa., is adding diamond dressing tools to its line of grinding wheel dressers. They are available in all sizes and types of nibs for any kind of diamond dressing requirements. The company also is adding a line of diamond hand tools, available in six sizes numbered from 1 to 6 inclusive.

TIME CYCLE FOR PROCUREMENT OF TYPICAL AIRCRAFT MAGNESIUM ALLOY SAND CASTINGS OVER FIVE POUNDS


DEADLINE FOR SUBMITTAL of WPB 3462
7th MONTH preceding delivery month
6th MONTH preceding delivery month
5th MONTH preceding delivery month
4th MONTH preceding delivery month
3rd MONTH preceding delivery month
2nd MONTH preceding delivery month
1st MONTH preceding delivery month
DELIVERY MONTH Shipments meeting requirements set forth in WPB-
for NEW CASTINGS
for CURRENT CASTINGS
15th
15th 25th
7th 12th
7th
Four copies of properly authenticated WPB-3462 forms submitted to Aircraft Scheduling Unit by 15th of this month. One copy of WPB-3462 and Purchase Order also mailed to supplier prior to 15th of this month.
Aircraft Scheduling Unit reviews requirements and makes allocation. Notice of allocation mailed to consumer and supplier by last day this month.
Allocation arrives at central planning office of supplier—correlated with purchase orders and working schedule set up.
Working schedule arrives at plant scheduling office. Plant labor and methods scheduling accomplished.
Plant changeover to new schedule.
Molding, pouring and processing of castings.
Castings shipped.
Castings from new patterns will not reach sizeable production during first delivery month.
Note: For the evolution of a fully serviceable casting having desirable founding characteristics, the closest cooperation among the designer the pattern shop and the foundry is necessary during the casting design and casting approval stages.
Pattern arrives at foundry for determination of method of molding and casting; for correcting and checking accuracy and quality of castings.
Four copies of properly authenticated WPB-3462 Forms submitted to the ASU by 15th of this month. One copy of WPB-3462 and purchase order also mailed to supplier prior to 15th of this month.
Orders for new pattern placed with pattern shop.
PATTERN UNDER CONSTRUCTION AT PATTERN SHOP
10 WEEKS FOR CURRENT CASTINGS
24 WEEKS FOR NEW CASTINGS

RISE of magnesium into the circle of widely used aircraft materials has raised sizeable and unexpected procurement problems. These problems have been intensified by the fact that many industrial purchasing departments have had to acquaint themselves with the new material and its problems in a minimum of time. Lack of familiarity with actual production procedures is a common difficulty; unfamiliarity with regulations governing the distribution of fabricated magnesium alloy products is another.

For over a year the Aircraft Scheduling Unit at Wright field, Dayton, Ohio, has stressed the necessity of close attention to *time cycles* in the procurement of controlled materials.

Magnesium is not a C.M.P. controlled material, distribution being by allocation, but with its wider application in aircraft production, a knowledge of the *time cycles* for procurement of magnesium commodities is of paramount importance.

The Materials Distribution Branch of WPB has prepared for ASU, with the assistance and co-operation of magnesium producers and fabricators, four magnesium alloy time cycle charts on castings, forgings, sheet and extruded products.

In the past, magnesium for fabrication has been allocated monthly by the Aluminum & Magnesium Division, WPB, on the basis of requirements submitted by aircraft contractors to ASU and approved by ASU. This procedure served the purpose of channeling the inadequate supply of magnesium ingot into those uses which the services considered to be of first importance.

With the improved magnesium ingot situation and increased demand for magnesium alloy fabricated products, ASU and WPB have co-operated in simplifying magnesium procurement and distribution procedure. The existing forms for requesting allotment have been eliminated, and since January requests have been made on Form WPB-3462, which applies to consumers who use magnesium products for non-aircraft purposes as well as those whose output is for aircraft. Aircraft consumers file with ASU; non-aircraft consumers with WPB.

Details of the manner in which the new procedure functions in procurement of sand castings over 5 pounds is shown graphically in the accompanying chart.

Form WPB-3462 must be submitted at least 10 weeks prior to the delivery month for all forms of magnesium.

The influence of delay factors in extending the procurement cycle must be considered continuously, and the time cycles shown on the chart are not to be interpreted as the exact time necessary to produce any magnesium alloy product. Most common among the delay factors are backlogs of orders and die or machine breakage. With regard to castings, the timely procurement and dimensional acceptance of pattern equipment has continued to be a basic problem. Delays from this cause can be averted by the allowance of an ample time margin.

Now that the light metal ingot picture is considerably improved, there is an increasing tendency for materials consumers to allow their purchase planning to become lax. Late ordering has been one of the most important causes of materials shortages in the past, and remedial action must be taken to prevent its becoming an even greater bottleneck in an expanding aircraft program. The Magnesium Sub-Unit of the Materials Distribution Branch at Wright Field, operating as a service organization for ASU, is prepared to assist contractors in obtaining delivery of critical magnesium products, but manufacturers can forestall their own shortages by taking into account the time cycles and delay factors in placing their orders.

Copies of the time cycle charts may be obtained from the Aircraft Scheduling Unit, Wright Field, Dayton, O.

Sales Organization Formed

DeBardeleben Coal Corp., Transportation Building, Birmingham, Ala., will market the by-product coke produced at its Holt, Ala., plant through its own sales organization after April 1. An increased tonnage of commercial grades will be available from that plant since considerable oven capacity now on furnace coke production as a war time service, will be released for commercial grades, including foundry and metallurgical.

WASHINGTON NOTES ★ ★ ★ ★

THE next few months may be more critical ones for some industries from the standpoint of labor supply. The period is expected to be marked by a heavy inroad by selective service into ranks of younger workers, the majority of whom, because of their age, have not acquired the skills which might make them irreplaceable and consequently subject to reclassification. As the draft call extends to the 22 to 38-year-old group of fathers, however, some government officials look for the manpower supply of essential industries to be increased by individuals leaving jobs which offer no release from a 1-A classification.

★ ★ ★

With well over a million more men likely to be taken from industry the first half of this year there appears no possibility of a marked change for the better in the industrial manpower situation—until the military picture becomes clearer. And the latter apparently must await the outcome of the European invasion. Meanwhile, as of Feb. 1 more than one-half the country's industrial areas were classified by the WMC as having an acute labor shortage, or no surplus of workers, or as expecting a shortage within 6 months.

★ ★ ★

SURPLUS of aluminum, marked by recent curtailment in annual ingot capacity by about 330,000,000 pounds, is unlikely to be followed by anything beyond cautious relaxation of previous prohibitions against the metal's use for certain purposes—unless scarcer metals or labor can be saved thereby. Moreover, there is not the same excess capacity in all fabricated forms of aluminum. Castings and forgings, for instance, are in a much tighter position than tubing, sheets and extrusions.

★ ★ ★

One of the bans lifted recently on aluminum use is for postwar experiments, such as models for civilian goods planned for manufacture in peacetime. Under the new policy, the Aluminum and Magnesium Division will approve requests for small amounts of aluminum for experiments, provided they can be carried out without diverting manpower, technical skills or facilities from activities connected with war work.

★ ★ ★

MAGNESIUM foundries now are permitted to accept the return of rejected or spoiled castings of their own manufacture without obtaining prior approval of WPB, and they no longer are compelled to sell such castings to a producer or approved smelter.

★ ★ ★

Cast iron soil pipe and fittings have been freed from restrictions formerly imposed by WPB. An A-10 or better rating previously was required for delivery of these products. Cast soil pipe remains subject to Order L-79, which controls distribution of plumbing, cooking and heating equipment.

★ ★ ★

VALVE manufacturers' output last year is estimated at 277,535 tons, and while the heavy requirements of various war programs have been met, it was necessary to expand production to many times that of the pre-war level. Production of fittings currently is 2½ times that of 1938.

★ ★ ★

Machine tool builders still had a $212 million backlog at the opening of this year. Should the December shrinkage of $35 mil.on continue, the industry's unfilled orders would be at bed-rock by June.

★ ★ ★

PRODUCERS of brass and bronze castings have won back part or all of the 1½-cent price reductions made by OPA about a year ago. The restoration amounts to ½-cent on the silicon bronze, 85-5-5-5, and 88-10-2 alloy groups, ¼-cent on the 80-10-10 and yellow brass groups, and 1½-cents on castings containing 97 per cent or more copper.

★ ★ ★

Recent reductions ranging from ½ to 1 cent per pound in prices of copper and copper alloy scrap apply only on sales to copper refiners and ingot makers. Grades affected formerly were bought by brass mills at prices beyond the reach of refiners and ingot makers, but with the mills turning to fired rifle shells and other types of scrap the cut-price grades now are available to ingot makers at prices comparable with those they normally pay for raw materials.

★ ★ ★

EASTERN ceiling prices on by-product foundry coke are up 50 cents, reflecting higher labor and coal costs. The first advance in eastern territory since 1941, it applies to all Atlantic seaboard states, Vermont, West Virginia and eastern Ohio.

★ ★ ★

Steel casting prices on various railroad items have been raised by an OPA adjustment of ceiling levels. Miscellaneous freight car castings are up 17 per cent, with smaller increases granted on a number of other products.

★ ★ ★

LATEST "Material Substitutions and Supply List" of the WPB Conservation Division shows the expected easing in copper and steel supply, no change in lumber, and a continued tight situation in tin. It is recommended that tin be used as little as possible in bronzes and plating.

★ ★ ★

The one exception to the easier position of ferrous material is malleable cast iron, which still is listed among materials in insufficient supply to meet war and essential industrial demands. The only ferroalloys remaining in this same group are columbium and nickel. Gray iron is included among materials readily available for essential uses, with cast steel placed in the group experiencing a fairly well balanced supply-demand ratio.

★ ★ ★

THE STEAM locomotive program for 1944 has been reduced from original schedules. Military requirements have been cut by 741 for 80-ton or heavier units and by 162 in the 50-80 ton size. This leaves more than 2000 large and 300 small locomotives to be built for military purposes and about 275 of all sizes for domestic use.

★ ★ ★

Total 1944 requirements for motor graders are placed at about 4700 units, 30 per cent more than in 1943. Relatively few will be available for non-military use.

W.G.G.

Gray Iron Advisory Committee Named

An industry advisory committee of the gray iron foundry industry has been appointed by the Office of Price Administration to confer with the latter on matters affecting prices of gray iron castings. It consists of: F. H. Rayfield, vice president, Potter & Rayfield Inc., Atlanta, Ga.; R. D. Phelps, president, Francis & Nygren Foundry Co., Chicago; C. C. Ford, contracting engineer, George C. Christopher & Sons Iron Works, Wichita, Kans.; Walter Chadwick, president, Davenport-Besler Corp., Davenport, Iowa; S. D. Russell, president, Phoenix Iron Works, Oakland, Calif.; H. L. Edinger, president, Barnett Foundry & Machine Co., Irvington, N. J.; W. S. Thomas, general superintendent, North Bros. Mfg. Co., Philadelphia; C. R. Culling, president, Carondelet Foundry Co., St. Louis; A. B. Root, vice president, Hunt-Spiller Mfg. Corp., South Boston; C. B. Magrath, president, Greenlee Foundry Co., Chicago; R. E. Kucher, vice president, Olympic Foundry Co., Seattle.

Cast Steel Output Higher in 1943

Production of steel castings in November totaled 158,690 short tons, against 163,888 in October and the 1943 peak of 176,470 tons in March, according to the Department of Commerce. Production represented 76.9 per cent of capacity. Orders booked in November were 209,276 tons, compared with 211,341 in October and 214,086 in September. These figures are compiled from reports submitted by various steel foundries but appear incomplete in view of a recent WPB release stating that total 1943 production of steel castings was 2,742,604 tons, compared with 2,239,693 tons in 1942 and 1,577,736 in 1941.

MOLDS LAUNDRY MACHINERY CASTINGS

(*Concluded from page* 102)

years the larger cupola has been in use melting the average daily heat of 40 tons. The wind goes on at 1 p.m. and the bottom is dropped between 3:30 and 4. Metal leaves the spout at a temperature of 2950 degrees Fahr. Progress of the heat, as indicated by temperature readings and quick chill tests, is marked on a blackboard in the immediate vicinity of the cupola. A mechanical device feeds the correct amount of calcium silicide to the stream of iron as it flows through the spout and into the ladle.

During the present emergency, with the regular product of the foundry limited to a considerable extent, the company has supplied several outside concerns with castings, including large numbers of cylinders, pistons and other castings for diesel engines in which high strength, machineability, clean surface and accuracy of dimensions are essential requirements.

The coremaking department, with ovens, racks, cars, benches and the usual supply of sand, rods, wires, etc., occupies the remaining space in the third or south bay of the foundry. Core sand mixtures are prepared in a muller type mixer set up in an adjoining room and transported by truck to the core room. New silica sand bonded with oil in the proportion of 1 part oil to 70 parts sand is used for all cores, with the exception of certain chunky cores in which the venting problem is not one of the main factors. Sand for these cores is bonded with a combination pitch and cereal binder. Several of the accompanying illustrations show cores destined to be almost entirely surrounded by metal. Obviously a high degree of skill and ingenuity on the part of the coremaker is required to insure the safe passage of a large volume of burning gas through one or, at most, an extremely limited number of small vent openings.

Holes Are Small

Another feature which must be anticipated is the removal of the core from the casting in the cleaning room. The entire mass must be removed through the small vent holes. Therefore the use of heavy reinforcing irons automatically is ruled out, and the number of small rods is held to a minimum. The group of cores shown in Fig. 1, typical of a wide range in sizes and shapes, illustrates this particular feature. The extra wide core shown on the truck is reinforced with four lengths of perforated ½-inch steel pipe, but in the majority of instances, only two lengths of pipe are employed. The pipes extend through the ends of the core and are enclosed in rectangular blocks of sand which serve as prints to locate them and hold them in place in the mold. Short lengths of ¼-inch steel rods are laid about 6 inches apart across the pipes and then sand is rammed by hand in and around pipes and rods. On the larger sizes, hooks are attached to the pipes to provide a means of handling the cores with a crane. The small open space around each hook on top of the core is filled with sand after the core is placed in the mold.

In service these castings are filled with live steam and therefore must be pressure tight. Following usual foundry practice, the concave face of the casting which later is machined and then polished to a dazzling brilliancy, is formed in the drag part of the mold. This precludes the use of chaplets under the core. However, chaplets are not necessary since the pipe extensions at the ends readily carry the weight. A few scattered chaplets on the upper face of the core prevent the core from bending and rising in the center when the mold is filled with metal. Numerous openings permit the molten metal to flow upward through the core and thus reduce the total static pressure. Later the various vertical columns of metal add strength and rigidity to the casting which is the shoe or polishing member against which the goods to be ironed are forced by the rollers in the assembled ironing machine.

Suspended from Cope

In a smaller type machine used for pressing garments, the core in the steam chamber is suspended from the cope. The only part of the mold in the drag is the convex mound of sand which forms the concave face on the casting. The remainder of the mold is formed in the cope. Several small projections from the main core enter corresponding prints in the cope. Wires extending from these projections are attached to short rods resting on top of the bars in the cope. They are pulled up tight with a pair of pliers, or a wood wedge is slipped under one end of the rod. Vent from the core follows the wires. With this arrangement no chaplets are needed either in the drag or in the cope.

Proper size, shape and position of the gates are regarded as major items in the production of clean and solid castings. The gates form part of the pattern equipment and are not left to the individual skill or judgment of the various operators employing a double ender or a piece of bent tin or brass plate. Obviously, a channel formed by the pattern will provide a smooth, clean, firm passage for the entrance of the metal into the mold. Considering that the entire amount of metal required to fill the mold has to pass through a single sprue, and through one or a limited number of gates, it should be apparent that these channels are subjected to more severe service than actual walls or parts of the mold itself and therefore should be prepared with the greatest care.

Typical gating arrangement on a circular casting, is shown in Fig. 3, a view of the drag side of the pattern. The metal first drops through the central sprue in the core into a small well which serves as a buffer or cushion to resist the impact from the falling column. From the well, the metal flows horizontally through four shallow passages which terminate in auxiliary sumps or traps for any small floating particles of foreign material. Backing up from these wells the metal flows at a tangent across and up the side of the core print into the mold cavity. By providing four gate entrances, only one quarter of the total amount of iron necessary to fill the mold enters through each passage. By placing the gate entrances 90 degrees apart the mold is filled rapidly and uniformly. For all the castings in this foundry the metal is poured fast and hot.

Pistons for diesel engines are molded and cast head down in a vertical position. The molds are made on a jolt machine and dried in the oven. The core is made in halves in the right and left hand corebox, and the halves are turned out on flat plates and dried in the oven in a horizontal position. Later the dried halves are assembled, pasted and wired and taken to the dry sand set-up floor where they are inverted and lowered into the molds. An extension shoulder at the top supports the weight of the core in the mold and also locates the core in proper concentric relation to the wall of the mold. Bars on top of the core are clamped to the upper flange of the flask to anchor the core in place. A circular basin is built on top of the core to deliver metal to four rectangular pop gates, 1 x 4 inches, located 90 degrees apart. The basin is flooded at the beginning and kept filled until the operation is complete.

Size and shape of pouring basins vary to suit various types of castings, but the practice of filling the basin before any metal enters the sprue is observed on practically all molds. A black washed, tapered cast iron plug is placed in the sprue opening. A short rod terminating in a hook extends upward from the plug. When the basin is filled with metal, the man manipulating the skimmer engages the hook, lifts the plug and lays it to one side.

A large and well-equipped laboratory provides facilities for maintaining close control over materials and processes, and to carry on experimental and development work.

Fewer Heat Treating Units Shipped

Shipments of heat treating furnaces have declined to a rate approximately one-half the peak level prevailing in late 1942 and early 1943, according to the War Production Board. October shipments of $6,010,000 compare with a monthly average of about $11,800,000 in the first half of 1943. Orders have dropped to less than $5,000,000 monthly from the $17 to $21 million pace of mid-1942, while unfilled orders have declined more than 75 per cent from the 1942 peak of $106,606,000 in July.

STRUCTURE CONTROL OF GRAY CAST IRON

(*Continued from page* 105)

decision. For example, the V-5 type alloy raises brinell hardness and increases density in all ranges of composition whereas the graphidox type normally reduces hardness. This frequently is very important.

As an example, if a heavy sectioned casting is being poured, the V-5 type might be required even in a low carbon-equivalent iron in order to insure sufficient density and to maintain brinell hardness. This is the case frequently in heavy machine tool castings and die blocks. It must be remembered that Fig. 5 can be applied directly only to 1.2-inch test bars. It is possible that a casting could be so light that even over 3.9 per cent carbon-equivalent, the graphidox type would be needed to avoid excess brinell hardness for the particular application.

In general, however, the graphitizing type inoculant is used in low carbon-equivalent irons which normally would range from a pure white structure to a structure containing only a slight excess of cementite if inoculation or graphitization was not utilized. The stabilizing type material normally is introduced in the higher carbon-equivalent irons or those that would be pearlitic or contain some free ferrite in the heavy sections if the inoculation was not used. The two types of inoculants may be combined in low carbon-equivalent irons to obtain unusually high physicals as indicated in the "double inoculation" curve of Fig. 5.

Choice of Inoculant

Another consideration which is sometimes a factor, is the remainder of the specification. For example, if the specification calls for the use of chromium, the stabilizing type inoculant would be indicated since it would be more convenient (and usually better metallurgically) than ferrochromium plus a graphitizing type inoculant. A decided economy can be realized by taking this fact into account.

The considerations mentioned apply only to choosing between two types of inoculants. The exact material of either type that is decided upon is determined usually by the normal factors of price per ton of iron treated, cleanliness of the material, ease of handling, solubility, and general foundry adaptability.

The exact amount of an inoculant which should be used in any particular application depends upon a number of considerations. In the first place, the effect of the ladle inoculant may not be a direct function of the amount used. Most of the ladle inoculants, particularly of the graphitizing type, actually may show decrease in effectiveness after they pass a certain percentage addition which varies with the composition of iron and the type of casting. Another factor to be considered is that insufficient material for complete inoculation (that is for the complete removal of type D graphite) may have practically no effect. This is particularly true if the molten iron is held in the ladle for an appreciable length of time. Therefore, there is a minimum amount of ladle inoculant which can be used economically.

For example, graphidox normally is used in amounts varying from 0.10 per cent to 0.20 per cent. Less than 0.10 per cent normally is insufficient to guarantee complete removal of objectionable microstructure. More than 0.20 per cent normally is unnecessary and beyond the optimum range, unless a great deal of chill reduction is necessary. There are instances where larger amounts, up to 0.50 per cent are used, but in this case the large addition is for the purpose of reducing chill drastically in addition to eliminating the type D graphite structure. To be specific, amounts up to 0.50 per cent graphidox may be necessary for converting white cast iron to gray cast iron without the necessity for annealing.

Larger Amounts Required

When using the stabilizing type inoculant, which is balanced by a stabilizing agent, larger amounts are required. As little as 0.50 per cent frequently is sufficient to eliminate type D structures, although the alloy was designed to be used on the basis of a 1 per cent addition. The maximum amount which may be used would then depend upon the brinell hardness desired. In special cases, as high as 3 per cent is used for introducing considerable quantities of chromium in addition to obtaining complete inoculation effects. Because of the balanced action of this material, the mechanical properties, with the possible exception of deflection, bear a direct line relationship to the amount added. This is illustrated in Fig. 7 which indicates the effect of varying percentages of V-5 on a base iron of approximately 3.40 per cent total carbon and 2 per cent silicon.

In the foregoing discussion it has been assumed that the amount of inoculant to be used is based primarily upon the desire for completely controlled structure or for the purpose of obtaining definite mechanical properties, marked chill reduction, or some other special effect. In each case it has been assumed that the desired chemical analysis is obtainable for the particular application. However, there are occasions in a foundry in which the anticipated analysis may not be easily secured.

For example, the charge may be set up to yield a silicon content of 1.8 per cent, and because of the unpredictable errors or variations in raw materials and discrepancies in weighing, the silicon may be 0.50 per cent too low. This would be indicated immediately by a chill test which would show the iron was much harder than anticipated. This discrepancy could be corrected by the use of a graphitizing type inoculant. However, this practice may be uneconomical in some cases, and may be undesirable for metallurgical reasons in other cases. This is due to the fact that graphidox is a more potent chill reducer than silicon, and in the case of our particular example, the use of this material to reduce the chill to its anticipated level may give a final analysis of only 1.45 per cent silicon. Although the chill would be in line with that expected, the properties of the iron would not be the same. The brinell hardness and tensile strength, for example, undoubtedly would be higher and the machinability would be poorer than anticipated. If these factors are present then the logical way to correct for insufficient silicon is to add more ferrosilicon.

This has led to the practice, in some plants, of using a small amount of graphidox (for example 0.125 per cent) to obtain structure control, and adding ferrosilicon to correct major errors in chemical analysis. In other plants it is common practice to melt an iron of unusually low silicon content deliberately and use a substantial amount of graphidox (0.40 to 0.50 per cent) and take advantage of the fact that the resulting iron will be somewhat higher in physical properties than if the higher silicon content were used originally. This is a widely accepted method for the production of high strength cast iron. The use of alloying elements in combination with such a practice has been responsible for the production of machineable cast irons of over 60,000 pounds per square inch; in fact, cast irons of approximately 80,000 pounds per square inch tensile strength have been recorded.

Chill Is Reduced

Another factor which should be considered when inoculating alloys are used for correcting analyses, is the fact that chromium in the form of V-5 type material does not increase the chill depth; in fact, an actual chill reduction usually is obtained from its use. Therefore, if ferrochromium is used for the purpose of increasing chill, the stabilizing type material may be impractical. If, however, the material is desired for the purpose of increasing the density, tensile strength and brinell hardness of the iron which would otherwise be too soft, the stabilizing type material may be used to advantage. The resulting iron then has the advantage of a lower chill than an uninoculated iron of the same strength and hardness. Actually, these materials are used widely for exactly this purpose.

It should not be assumed that either type of inoculant is designed primarily for the purpose of correcting chemical analyses. While such correction of chemical analysis is, as just pointed out, possible through use of these alloys, their maximum value results from addition to irons in which the initial chemical analysis is exactly as desired for the particular casting, since their prime function is the control of structure. These improvements in structure usually are accompanied by a general increase in physical and mechanical properties.

Although the materials being discussed are termed ladle inoculants, usually they are added to the cupola spout as the ladle is being filled with molten metal, but they may be added directly to the ladle. The prime consideration is to ensure complete solution and dispersion throughout the ladle of iron. This is relatively simple since most of these materials are readily soluble in molten iron at the usual temperatures. In those cases in which inoculation is used on only a small percentage of the total irons made, the accepted method of making the addition is by means of a funnel suspended above the spout in such a way as to introduce only a relatively small amount of material at any one time. Some of these materials, however, are so soluble that some foundrymen merely throw the required amount of alloy in the bottom of the ladle and tap on top of it. This is not to be recommended as general practice, even though it has been found to operate entirely satisfactorily in many cases.

In foundries using ladle inoculants throughout the entire heat, some mechanical means of introducing the material may be distinctly advantageous. These systems usually incorporate a screw conveyer or vibrator type unit which will deliver a specified amount of material in a specified time, as shown in Fig. 8. This makes it possible for the operator to introduce the required amount of alloy in the ladle merely by pushing a button for a specified number of seconds. Some systems have gone to the extent of adjusting the rate of delivery of alloy to the rate of flow of iron through the tap hole so that alloy is being delivered as long as the metal is flowing down the spout. This practice would be unnecessarily elaborate except in those cases in which the amount of iron in each ladle cannot be anticipated, as would be the case in a fore-hearth or receiving ladle.

Choice of Two Methods

Where receiving ladles or fore-hearths are utilized, the iron may be inoculated before entering the receiver or as the metal is being tapped from the fore-hearth into the ladle. The former method has the disadvantage of being more difficult to regulate since the amount of iron which is to be delivered to the fore-hearth may not be known. The latter method has the disadvantage that the metal is somewhat colder and the rate of solubility thereby somewhat reduced. Normally, however, it is important to tap the metal from the fore-hearth at a high temperature anyway so that solubility need not be a problem. There is the factor of the time effect involved in this particular case which will be discussed later.

Ladle inoculants are extremely easy to handle in a foundry if certain fundamental considerations are accepted and allowed for. In the first place, the iron necessarily must be sufficiently hot to insure complete solution. Temperatures of 2650 to 2700 degrees Fahr. are sufficient although higher temperatures usually are desirable. In the second place, it should be remembered that all ladle inoculants in general use today are active deoxidizers, and that if they come in contact with slag they will tend to reduce the slag and may not be available for the purpose of inoculating the iron. Therefore, the surface of the metal at the time of introducing the alloy should be clean. This automatically is taken care of when the materials are added in the spout of the cupola; particularly if the alloy funnel is far enough from the end of the spout to permit solution of the inoculating material before the metal enters the ladle.

If the ladle inoculant is permitted to enter the slag instead of the metal, the volume of slag and its fluidity probably will be increased, and there will be a loss of inoculation effect. Therefore, this becomes important in the correct handling of these materials.

(To be concluded)

OBITUARY

WILLIAM M. BYRD JR., 69, president, Alabama Pipe Co., Anniston, Ala., died in that city Jan. 30. Mr. Byrd had spent all of his industrial career in the iron and coal industry. Originally associated with the Woodward Iron Co., Birmingham, he later joined Horace Hammond in organizing the Hammond-Byrd Iron Co., Birmingham. Subsequently Mr. Byrd, together with former Gov. T. E. Kilby, O. A. Hamilton and W. F. Johnston, formed the Alabama Pipe Co.

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Henry E. Miller, 80, president, Chicago Wheel & Mfg. Co., Chicago, and one of the oldest active men in the grinding wheel industry, died Jan. 10 in Chicago. Mr. Miller entered the industry in 1894 when he was made manager of the Chicago Emery Wheel Co., which he later purchased. In 1895 he became president and gave the company its present name. Mr. Miller was one of the founders of the Grinding Wheel Manufacturers Association.

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A. Edmond Park, 44, president of Flint & Walling Mfg. Co. Inc., Kendallville, Ind., died Jan. 24 in that city. Mr. Park joined the company in 1921 following his graduation from the University of Pennsylvania, and became secretary in 1926. He served in that capacity for 13 years, advancing to the presidency upon the death of Herbert H. Macomber in 1939.

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Fred Stiehl, 63, for many years foundry superintendent, Malleable Iron Fittings Co., Branford, Conn., died in that city Dec. 25. Mr. Stiehl was born in Newark, N. J., and at the age of 16 began a foundry apprenticeship at the Meeker foundry. Later he worked at the Hughes & Phillips foundry for 4 years. In 1910 he was appointed foundry foreman at the Globe Foundry, Syracuse, N. Y., where he remained for 10 years. In succession for varying periods he served as foundry superintendent at the plants of the Vermillion Malleable Iron Works, Hoopestown, Ill.; Peoria Malleable Castings Co., Peoria, Ill.; Meadville Malleable Iron Co., Meadville, Pa.; International Harvester Co., Chicago; and Malleable Iron Fittings Co., Branford, Conn., from 1929 until his death.

• • •

Prof. Joseph F. Oesterle, Department of Mining and Metallurgy, University of Wisconsin, Madison, Wis., died recently at the age of 55. He was born in Philadelphia, and was graduated from the University of Wisconsin in 1913. Professor Oesterle served as a metallurgist with the Pennsylvania railroad until 1916 when he became metallurgist for the Illinois Steel Co., Gary, Ind. In 1918 he enlisted in the armed services, and after his discharge served as associate physicist, Bureau of Standards, Washington. In 1921 he returned to the University of Wisconsin, and in 1940 was appointed chairman of the Department of Mining and Metallurgy. Professor Oesterle was active in and served on committees of the Wisconsin Chapter of the A.F.A., and was actively associated with other technical societies.

• • •

William E. Malpass, 81, founder of the East Jordan Iron Works, East Jordan, Mich., and the last of the Charlevoix county pioneer industrial leaders, died Jan. 6. He was born near Dursley, Gloucestershire, England, and left home at the age of 16 to come to the United States where he learned the foundry business in Detroit and Elk Rapids. In 1883 he and his father-in-law, R. W. Round, built a foundry in East Jordan. In recent years three sons, William H., Richard and Theodore, and a grandson, William E. II, have been associated with him. An interesting chapter in his long and colorful life covers a labor shortage period during World War I when he operated his foundry with a force recruited largely from pure-bred American Indians.

• • •

William H. Freiburger, 53, general superintendent of the National Smelting Co., Cleveland, died in that city Feb. 5. Mr. Freiburger was born in Buffalo and was graduated from the University of Wisconsin. He joined the Aluminum Co. of America and was superintendent of its Niagara Falls works before going with the National Smelting Co. in 1930.

• • •

Herbert T. Elmer, 60, superintendent of the Texas Electric Steel Casting Co., Houston, Tex., for the past 15 years, died in that city Jan. 30.

• • •

Max Lehman, 70, a founder and for many years president of the Quincy Pattern Co., Quincy, Ill., died at his home in that city Jan. 21.

• • •

William O. Vilter, 82, president of the Vilter Mfg. Co., Milwaukee, and active

in the company for 62 years, died Jan. 31 in Milwaukee. He joined the company, formed by his father and Peter Weisel in 1879, as a bookkeeper, and 4 years later became secretary. Mr. Vilter had been president since 1934.

• • •

Charles T. Gerding, 60, superintendent of the Allyne-Ryan Foundry Co., Cleveland, for 32 years, died in that city Feb. 10.

• • •

William J. Jones, 88, formerly general foreman for Robert Holmes & Bros. Inc., Danville, Ill., died at his home in that city Jan. 17.

• • •

Damon B. Wack, 37, executive vice president of the National Bearing Metals Corp., St. Louis, died in that city Feb. 1.

• • •

Albert T. Sebek, 57, president, Central Die Casting & Mfg. Co. Inc., Chicago, died Jan. 16 in that city.

• • •

Walter H. Hallsteen, 53, vice president and treasurer of the Ilg Electric Ventilating Co., Chicago, died Jan. 15.

• • •

Charles Frankl, 77, who retired in 1925 as president, Elizabeth Street Foundry Co., Chicago, died Jan. 20 in that city.

• • •

James E. Kelly, 64, owner, Chicago Brass Works, died Jan. 19 in that city.

Safety Service for Small Companies

The National Safety Council, 20 North Wacker Drive, Chicago, is offering a new membership service designed exclusively for companies with 100 employes or less. A recent survey of hundreds of industrial organizations in this size group, covering seven different industries, showed that their average accident frequency rate was 47 per cent higher than the average for the largest organizations in the same industries, and also was higher than the average for the entire industry. The new membership service is intended to fit the needs of small organizations in safety work.

Valve Simplification

Division of Simplified Practice, National Bureau of Standards, Washington, has prepared a "Simplified Practice Recommendation for Bronze Pop Safety Valves, and Bronze, Iron and Steel Relief Valves" which will satisfy 95 per cent of the demand for such valves for steam, oil, water, air and gas in industrial service, and for marine service where applicable.

George R. Mowat Co., New York, has appointed the Thompson-Hayward Chemical Co., Kansas City, Mo., representative for sale of Griffin's protective coating.

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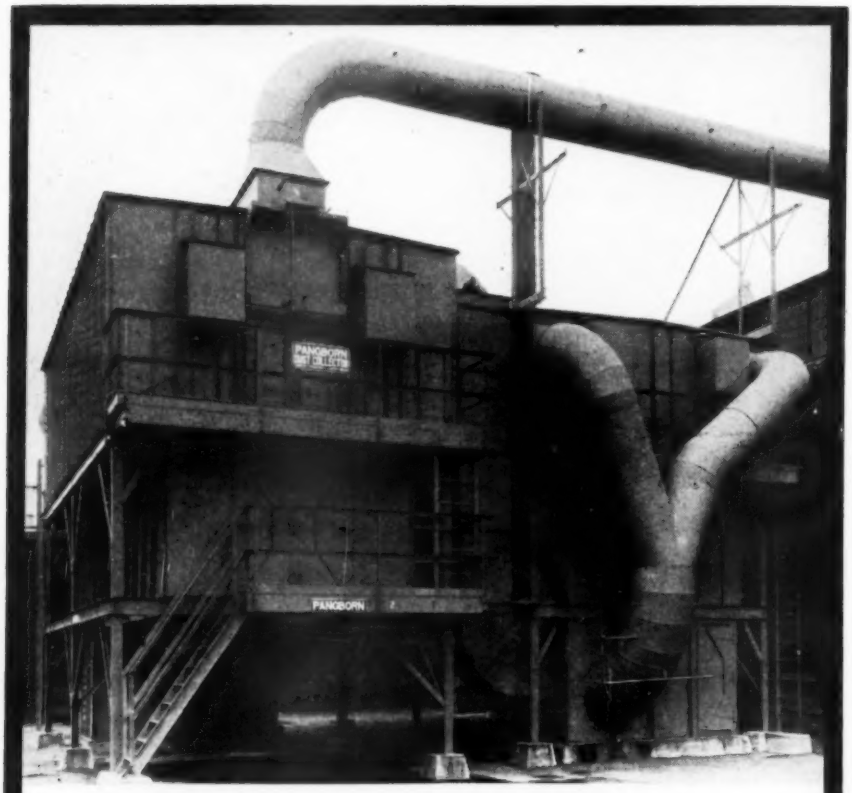

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METALLIC MATERIALS REPORT

(*Continued from page* 106)

When these requirements and the ability to meet them are rigidly put in the correct numbers, engineering design can proceed soundly. When either the needs or the properties are put only in vague, qualitative terms, we have to guess at what we want, and at whether a given material will fill the want.

Whether or not a test appraises the adequacy of a material for specific engineering use depends on whether the design engineer can put his questions in terms like pounds per square inch and whether the testing engineer can give his replies in the same terms. Unless each can, and does do this, the only recourse is to the automobile proving ground type, or the simulated service type of test.

The time when simulated service tests are necessary is when the engineer is unable to determine the kind, distribution, and intensity of stresses applied in service, or when unknown and fluctuating temperatures, or special corrosive atmospheres of variable composition are concerned. Resorting to simulated service tests is a confession of ignorance about the fundamental factors of service or of the relative importance of these factors. But when one is ignorant, it is far better to confess ignorance and proceed to acquire information, than to specify by guess.

Prevent Wild Guesses

Breaking down the service into its true factors, measuring service stresses, temperatures, etc., instead of guessing at them, then evaluating materials by more quickly and easily made specific tests which take the factors into account one by one, will free the engineer from the danger of making wild guesses, and greatly reduce the necessity for simulated service tests.

So let us consider the piece-meal tests, those supposed to answer some particular question about the attributes of a material.

From the standpoint of the testing engineer, descriptions of service requirements phrased in pounds per square inch, presumably can be met by straightforward testing, those not so phrased can only be answered indirectly, if at all. It is such considerations that lead the aircraft engineer to plaster sensitive, short-length strain gages all over the airplane and its component parts, with continuous recorders, and put the aircraft through its paces, in order to get a record of what the service stresses really are.

What use the designer can make of a test, the value of the information he gets from the results, and the weight he ought to give to them, are indicated pretty clearly by whether or not the re-

sults are reported in pounds per square inch.

Tests for yield strength in tension, torsion, or compression; endurance tests on standard or on notched specimens; and a very few other tests, are reported in pounds per square inch. Elongation and reduction of area in the tension test, notched bar impact tests, wear tests, etc., are not. The data from these tests cannot be used directly and quantitatively. They must be interpreted. The tests are only good for what they imply, or as they approach simulated service tests.

The simplest test of all, that for indentation hardness, is also good only for what it implies, but its implications as to strength, wear resistance, machinability, etc., are pretty good, primarily because the test itself uses a "pounds per square inch" method. Furthermore, hardness testing is so universal that the correlation of hardness with performance rests on abundant data. However, with the other tests that do not directly measure the quantity sought, but are only of value for what they imply, like the notched bar impact test, not enough work has been done to provide data for sure correlation.

If we keep the "pounds per square inch" theme in mind, we shall be able to think more clearly through some of the mazes of specification-phrasing, test methods, and interpretation of tests.

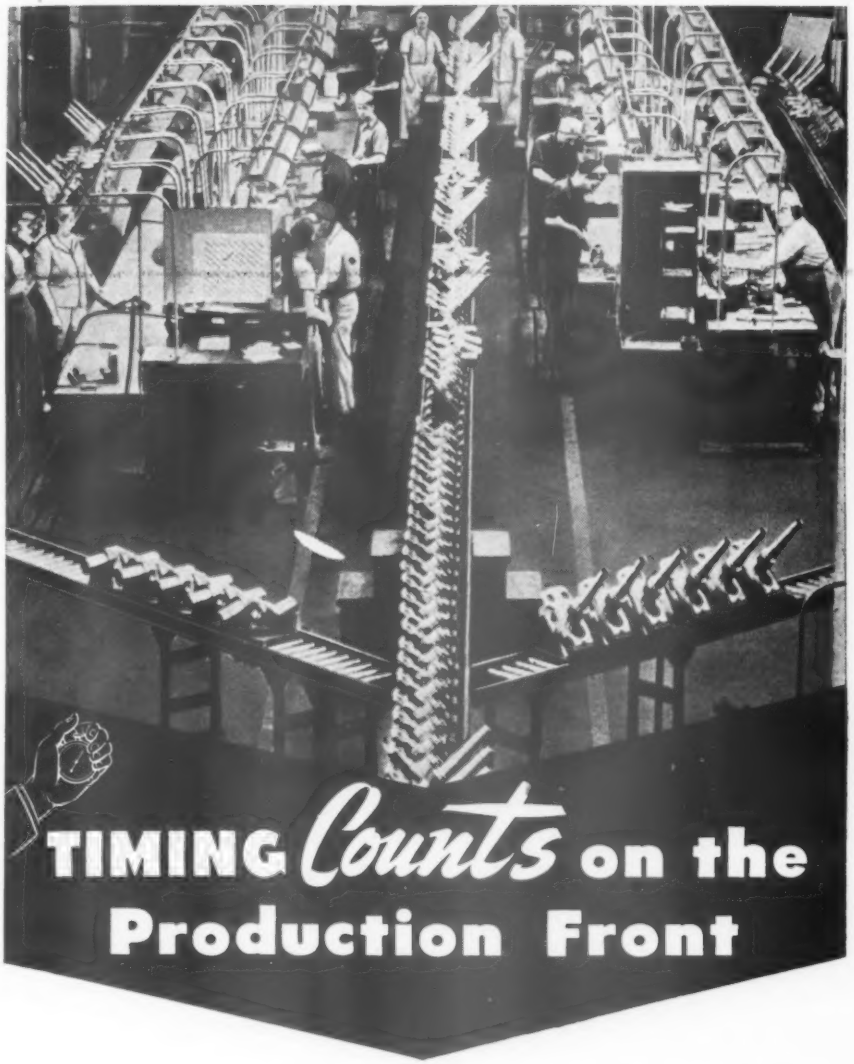
All Inches Are Not Alike

The "per square inch" part of the phrase, implying that each square inch of section behaves alike, is not the least important part, for a lot of metallurgy is concerned with seeing to that, and a lot of highly useful testing has for its purpose establishing whether or not each square inch is like any other square inch. Hardenability testing tells whether, in a given section size, we will get homogeneity of structure or not, and it is for overcoming the propensity of large sections to have their interior different from the exterior that alloys are added to steel.

The magnetic powder, magnaflux, and similar methods of testing for presence of cracks and of inclusions at the surface are of their admittedly great importance because they show whether the surface is or is not homogeneous with the interior —the "square inch", and also show whether there are stress-raisers at the surface that make our calculated "pounds" an inaccurate and unsafe calculation.[4]

X-ray and gamma ray radiography have similar application for detection of flaws and slag particles. These nondestructive methods show some types of gross inhomogeneities. Then the destructive method of cutting up and examining the structure by deep etching and under the microscope gives a further evaluation of homogeneity.[5, 6]

On the whole, a method that gives clear-cut results about "pounds", about "square inches", and especially about "pounds per square inch" tells the designer what he needs to know, with very little chance of putting him on a false



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trail, whereas those figures that do not come into this category often tell him that for which he has not the slightest need, and that which may, indeed, often lead him astray.

In a way, hardness tests are of the "pounds per square inch" type. A hardness test does tell considerable about "pounds", and a series of hardness indentations tells a lot about uniformity of the "square inches"; hardness tests will also tell much about uniformity of materials and of final parts from lot to lot. Thus, in testing armor plate, one plate in 100 may be subjected to a firing test, the other 99 may be checked for hardness.

Hardness has strong connotations about machinability, but a hardness value is not itself directly usable in design, because, like the tensile strength, discussed later, it involves deformation far beyond what can be allowed in service.

The primary criterion of load-carrying ability is yield strength, the unit load that can be carried without appreciable permanent deformation, so that when the load is released the piece returns to its original, unloaded, dimensions and position.

Apply Several Tests

Yield strength may be determined in tension, in compression or in torsion, depending on how the load is to be applied in service. Tension testing is the easiest, and is usually adequate because steels have about the same yield strength in compression as in tension. Cast iron is much stronger in compression than in tension, but, for any given type of alloy the compressive and torsional yield strengths are usually so directly proportional to the tensile yield strength as to be sufficiently indicated when it is known.

Yield strength is a directly usable, engineering design criterion of static load-carrying ability. It supplies the universal language for appraisal of load-carrying ability of any material, hence, it is, next to hardness, the test most universally made.

The yield strength test gives pounds per square inch, but it is important that the "square inch" represents what it is supposed to. Tensile tests of heat-treated steel generally are made on specimens roughed out almost to size, with only a final grinding allowance, i.e., they are heat-treated in about 0.505-inch diameter specimens. In such sections many steels are fully hardenable that are not hardenable in larger section. The yield strength values obtained on the small section are only true for the large section when the large section itself hardens clear through.

Besides this, heavy sections of any sort, heat-treated or not, are likely to be softer at the core than at the outside. Hence, yield strength figures need scrutiny to be sure that they truly represent the whole, or that part of the cross section in which we are interested.

In the course of the determination of yield strength, it is possible to determine

the modulus of elasticity, i.e., the reciprocal of the elastic deformation per unit stress. This requires care in testing, a long specimen, and measuring equipment of high sensitivity, for accurate results.

There is little need for routine determinations of modulus, it is a property that we have to take as we find it, for we cannot control it, it is fixed by the nature of the material. All ordinary steels, nearly up to their yield strength, have closely the same modulus of elasticity, the same springiness. It is the yield strength that determines the range within which a steel spring can be loaded, for, whether it has a high or a low yield strength, the modulus of steel comes in the range 27 to 31 million pounds per square inch. Composition and heat treatment are not factors that influence modulus to any noteworthy degree.

The nonmagnetic types of stainless steel and high-manganese steel show relatively minor deviations in modulus of elasticity, depending on the amount of cold work that has been put upon them. Thus the modulus of stainless steel may range from 25.5 to 29 million pounds per square inch.

Figures Have Direct Meaning

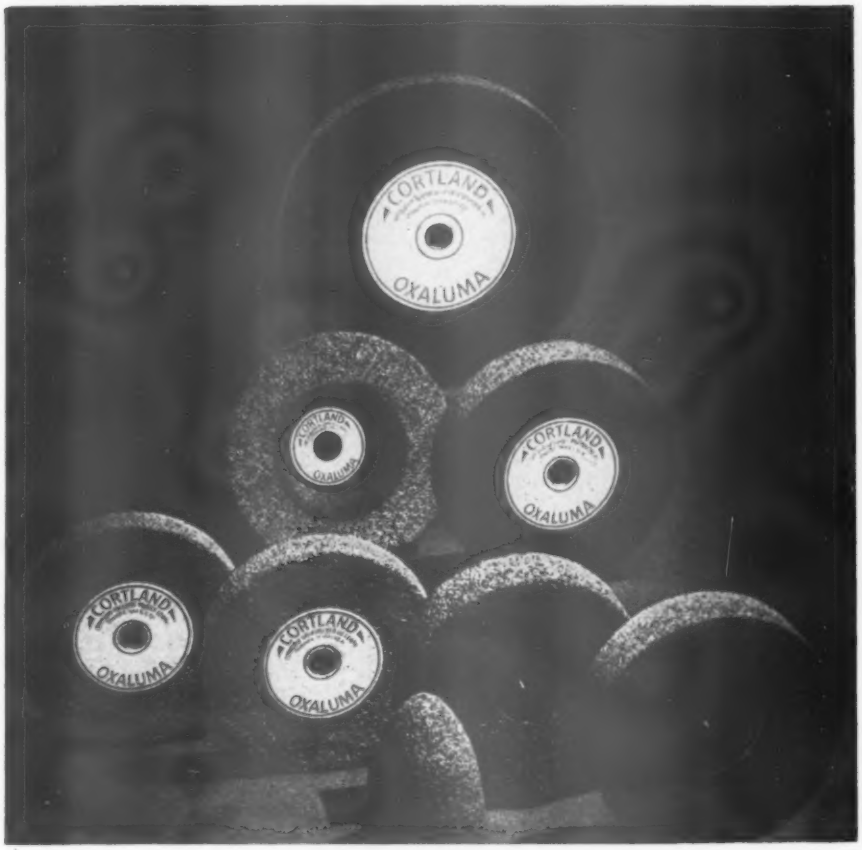
Strong cast irons have a modulus approaching that of steel, weak ones may have one of only 12 million. Many nonferrous alloys have still lower moduli and when stiffness is required by design, the modulus has to be considered when shifting from one type of alloy to another.

However, there need be no uncertainty about stiffness design, for the modulus is capable of precise determination, the figures have direct meaning.

If the pull on the specimen used for measuring yield strength is kept up, the specimen starts to yield, to deform permanently, and finally breaks. The maximum load withstood up to fracture, divided by the original area, before deformation, gives the tensile strength.

Cases where the engineer uses tensile strength directly are almost as rare as hen's teeth. Complete rupture in engineering applications only occurs in protective devices, such as shear pins, fuses, bursting disks and the like, or in such things as high explosive shells. Everywhere else, the engineer designs for life, not for failure. In cast iron and a few nonferrous alloys and in fully hardened, untempered steel, there is no true yield, the tensile strength is very little above the yield strength. Engineering steels and nearly all engineering nonferrous metals have a considerable gap between yield and tensile strengths, a range of plastic action. This plastic action is utilized in cold-forming, it is not utilized in normal service of a completely finished part, save as possible insurance against shattering failure when an accident occurs.

Tensile strength, and the range of plastic action between yield and fracture are therefore figures in which the engi-



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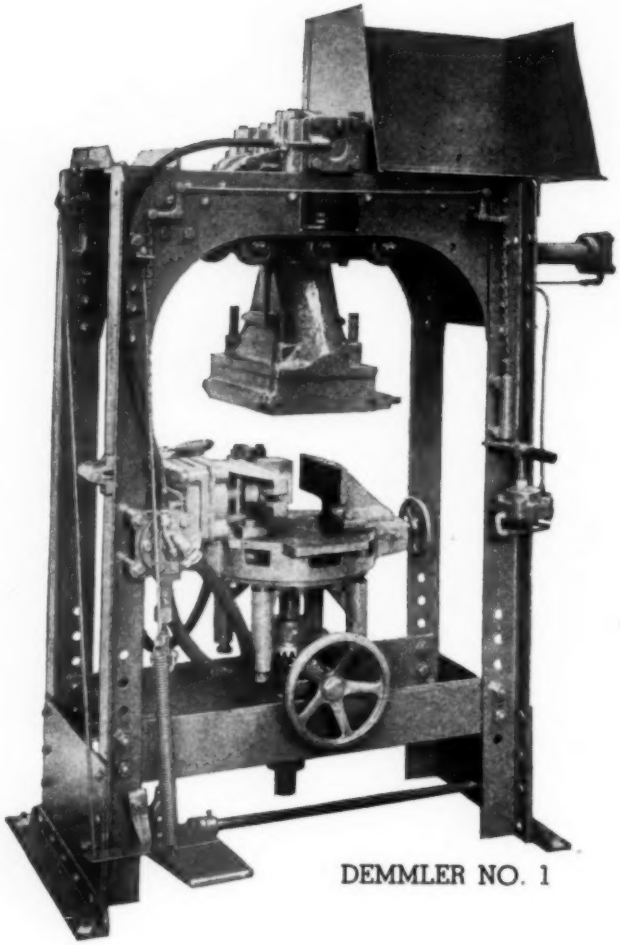

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neer has some interest, but seldom can he use them directly in design.

The ductility values, elongation and reduction of area, determined in the course of carrying the yield strength test clear to fracture, are not in pounds per square inch; they are in per cent of the original length or area. The engineer does not and cannot use the figures in design. The fabricator does not and cannot use them directly to appraise ability for cold-forming. Both use them only in indirect fashion, for what they connote rather than what they state. The ductility figures do give a rough idea of the reserve of plasticity available for insurance against shattering fracture in an accident.

Many specifications demand high values for elongation and reduction of area, though normal service could not endure 1 per cent of plastic deformation, and even when normal service demands a slight local ability for plastic adjustment, to distribute load in an imperfectly matched structure, as in a riveted bridge or in non-axial loading under tensile stress, this local adjustment will probably not exceed 1 per cent.[7]

Jackman[8] remarks that many aircraft structural designers believe that 3 to 5 per cent tensile elongation in certain aluminum alloys is adequate for most design conditions.

Argument Is Weak

Some writers argue that because triaxial stresses tend to reduce the ability of a metal to undergo plastic flow, a large degree of tensile ductility should be present to allow more plastic action. The weakness of this argument lies in the fact that large tensile ductility does not insure against poor plastic behavior under triaxial loading. Copper, extremely high in tensile ductility, nevertheless is quite notch-sensitive. Rate at which a metal cold-works, becomes strengthened, and passes on the load so that the load becomes distributed over a larger volume, plays a considerable part in its behavior. So many factors, acting at the same time, control the behavior of a metal seeking to flow under triaxial stresses that such behavior of that metal is not revealed adequately in the ordinary tensile test.

Direct testing under the complex loading conditions of service on the actual part, in its actual size and contour, needs to be resorted to rather than to assume that a taffy-like behavior under a straight pull on a smooth, round bar, is necessary.

Osgood[9], speaking of normal adjustment to tensile stress, as "accident insurance", indeed, remarks that it is the stretching *prior* to necking that counts and advocates noting the general elongation, exclusive of that in the necked portion.

In *service*, as contrasted with a forming process, reduction of area and local elongation accompanying it, are not likely to come into play. By the time the applied stress has risen so high that local necking, of the type measured in the

conventional tensile test, starts, the change of overall dimensions through prior stretching will have become too great for the proper functioning of most parts in service, hence the reduction of area normally measured, may be classed, along with excessive elongation, as unusable in ordinary service, and no certain indication of behavior under triaxial loading. Sachs' "notch ductility" may offer a better evaluation of the ability to redistribute stress through very local plastic flow.

For one given material, wide variations in ductility indicate that something has been altered in the processing of the material. The absolute level of the ductility figures means nothing unless it is related to a certain material. For one grade of cast steel 24 per cent elongation may be characteristic; for steel in certain big guns, 17 per cent; for one heat-treated aluminum alloy, 12 per cent; for another, 7 per cent; for a spring steel, 4 per cent; for cold drawn bridge wire, 2 per cent; and for some zinc-base die-casting alloys, under 1 per cent. Each is a usable material and all right of its kind. We don't call for the same height and weight in a St. Bernard and a Scottie. Large deviations from the characteristic value, whether up or down, raise doubts as the sample tested being a normal example of its kind, with dogs or with metals. Wide variation from the norm raises a presumption that other desirable properties, which we do not wish to go to the trouble of measuring, may also vary from their norm.

Ductility Is By-product

It is only because ductility values are regularly secured as a by-product of the directly valuable yield strength determination and thus are available in quantity, that we tend to use them as indirect criteria of quality, when they do not at all measure the quality we need. This familiarity with the normal, usually far super-abundant, ductility of the material formerly used, is likely to influence our thinking in respect to a substitute, and to make us reject, without trial, adequate materials of lower ductility. When we free ourselves from these false limitations, we are more likely to think of such substitutions as the Ford cast crankshaft and the glass gage. Zero ductility is acceptable in the actual service of both, and, when we stop to analyze the service, few services call for much ductility. Fabrication is, of course, another matter.

We need more searching and more direct tests than ductility tests, instead of relying so implicitly upon the hoped-for, but unproven and generally nonexistent, correlations between the ductility figures and some other unnamed and untested property.

Of as much importance as the knowledge of yield strength, the load-carrying ability for one application of load, is the endurance limit, the load carrying ability for many applications of load.

Under repeated stress, failure may occur, in apparently brittle fashion, at

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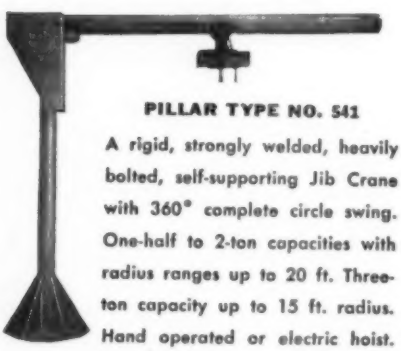

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stress levels well under the yield strength, and without measurable deformation.

The nucleus of failure is almost invariably some sort of a stress-raising notch, or poor fillet, whose avoidance comes within the field of the designer, or an accidental nick or a roughness of the surface from the type of machine shop finish used. Mere weakness of the surface, due to decarburization, often plays a part in steel.

Two opposing factors operate during repeated stress, one the damaging action that finally results in cracking, the other a cold-working action that strengthens the material.

In general, endurance against repeated stress, on polished bars, rises as the tensile strength increases, though, as is particularly evident in the case of some aluminum alloys, it is always true that the stronger the alloy the higher its polished-bar endurance.

In ordinary steel, however, there is a rather close relationship between tensile strength and polished-bar endurance, but in notched-bar endurance, the stronger steels are damaged much more easily, they have too little ability to be cold-worked without cracking, and are more notch sensitive in fatigue.

Endurance Limit Is Real

The stress level at which strengthening by under-stressing is so potent that the material will last for an indefinite number of cycles, is the endurance limit. Steel has a real endurance limit; if never stressed above that level, it would last forever, as far as we can determine. In most nonferrous alloys there is no such sharp limit, at low stresses the strengthening effect predominates over the damaging effect of overstress but is not able to keep up this dominance indefinitely. Ultimately the limit of the ability for local cold-working is reached and further repeated stressing produces damage. Hence, the endurance limit for steel can be established satisfactorily by running 5 or 10 million cycles, but in nonferrous alloys not less than 50 million, preferably 200 to 500 million cycles are imposed in careful testing. The endurance stress figures for nonferrous alloys need to be accompanied by a statement as to the number of cycles to which testing was carried.

Testing can be speeded up by running a steel for a couple of million cycles or a nonferrous alloy for 25 or 50 million, then raising the stress to a higher level which, by previous tests at that higher level, alone would break the specimen in, say a quarter million cycles for steel or 5 million for nonferrous alloys, and observing whether the specimen lasts longer than that figure. If its life at the raised stress is appreciably longer, the evidence is good that, at the lower stress, the strengthening effect so predominated that a very much longer life would have been shown had the testing been continued at the lower stress.

Short cut methods for evaluating en-

durance have been suggested, but none of them has proved reliable.

The curve of stress vs. number of cycles, obtained in a fatigue test, with each test run at one stress only, is called the *S-N* curve. Because of the large numbers of cycles, it is plotted on log-log, or semi-log coordinates. Testing at one selected high stress, and evaluating results on the basis of the life shown, has its uses, and far too little attention has been paid to the high stress end of the *S-N* curve, but scatter makes these data difficult to interpret. The position of the endurance limit or the stress for 500 million cycles is an important piece of engineering information that ought not to be omitted, even when chief interest centers on stresses for much shorter lives.

Data are needed, in any fatigue study, on the best the material is capable of when not handicapped by stress-raisers, shown by the *S-N* curve for well-filleted smoothly-polished specimens, and on what it will do under extreme handicap, shown by the *S-N* curve for severely notched specimens. Specimens with square notches, V notched, with threads, or with a hole bored through, would serve for the latter.

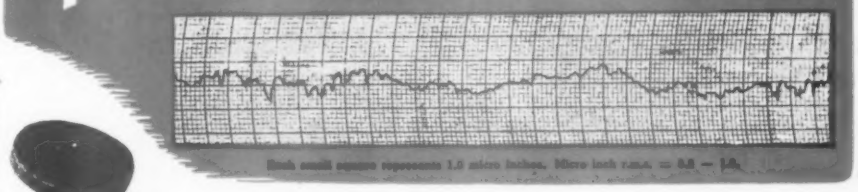
May Not Reach in Practice

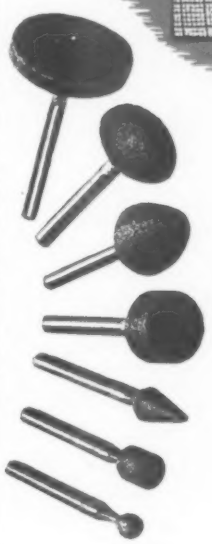
Many engineering parts, subject to repeated stress, have to have threads, oil holes, etc., and others, either intentionally for production reasons, or through oversight or accident, are not smooth, but have stress-raising small-radius fillets, notches, scratches, etc. The "polished endurance limit" figure sets up a par value for a material, which the engineer could utilize in toto if he were able to avoid stress-raisers, but which he may not be able to reach in practice.

The need for notched-fatigue testing, to supplement polished-bar fatigue data, hardly could be overemphasized, since the notched-fatigue limit is a vital, "pounds per square inch" value for the designer, and many materials and many conditions of heat-treatment that show superb polished-bar results fall down terribly in the notched conditions. Yet the polished-bar results are equally needed, especially to impress on the designer how much further he could go in raising fatigue life if he would avoid all stress-raisers.

The two "pounds per square inch" values, polished-endurance limit and square-notched-fatigue limit provide figures as directly usable as is the yield strength. As in that case, the "square inch" needs attention. Standard fatigue specimens are of small breaking section so that cheap machines will provide adequate load. In heat-treated steel the same old question of depth hardening, whether a tiny, fully hardened specimen correctly represents the large cross section of the actual part, comes in. There is also a question of the "size effect." As usual, the very large section does not have the full unit strength of the very small section. This has led to building equipment for fatigue-testing

Proof of a Better Finish





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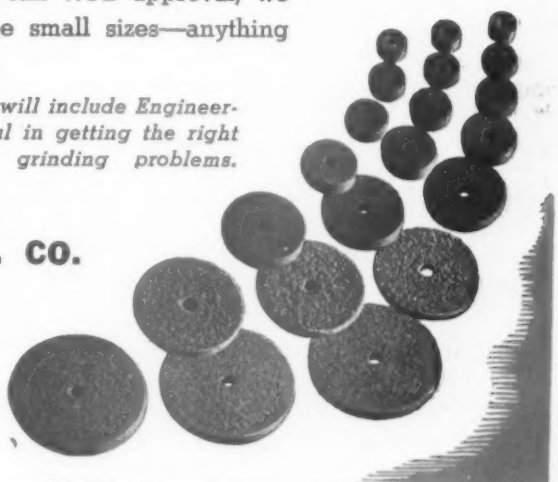

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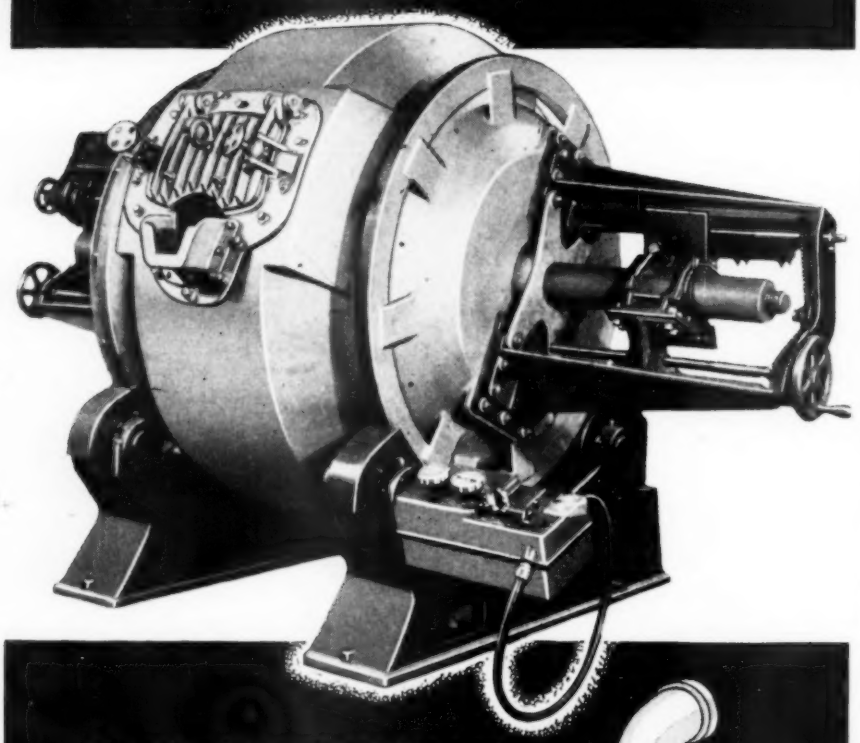

There are two main reasons why Detroit Rocking Electric Furnaces give you better Metallurgical results. They provide an automatic stirring action under non-oxidizing conditions and they allow precise control of time, temperature and composition.

Because of their high melting speed you can produce as many as eight ferrous heats or sixteen non-ferrous heats in one eight-hour shift. And you pour these heats with a minimum of dirt, fumes and hard work.

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full sized railway axles.

Fig. 3 shows the behavior of steels of different strengths and hardness, tested in fatigue as polished bars, bars with notched, or polished bars with simultaneous corrosion. This brings out two important facts, first that when notches are present, very strong steels as a class are no better than moderately strong ones, second, there may be a high degree of scatter in fatigue results of different steels of the same static strength.

In fatigue testing there is no analogy to the ductility measurements of the tensile test. Fatigue fractures may, and usually do, occur without any measurable permanent distortion of the piece. Such fractures may, and usually do, occur when no applied stress has ever been as high as the yield strength. In line with this is the fact that the ductility values determined in the tensile test, have no correlation with fatigue resistance. The gross phenomena of stretching and necking down have no opportunity to come into play. The same is true of the notched-bar impact test, whose results throw no light on fatigue problems.

That is, in fatigue, notch sensitivity is measurable only by the ratio between the polished endurance limit and the notched endurance limit; there is no other criterion. The notched-fatigue limit has to be determined directly.

Places Engineer in Quandary

If we know that the repeatedly applied stresses are at a definite level, the endurance and the notched-endurance limits have a "pounds per square inch" meaning. If stresses above those limits are to be applied, but the engineer cannot state their intensity or number, but nevertheless demands evaluation of a material for "guts" to stand undefined overload punishment, the testing engineer is in a quandary.

Most engineering metals will stand quite a number of quite high overloads without distortion or damage, that is, if the repeated stress is thereafter lowered to that of the endurancae limit, the not-too-greatly-abused specimen will last indefinitely, in spite of having been overloaded. The part would fail if the overloads were indefinitely repeated, yet it will not even distort in one such overload below the yield strength.

Reasonable basis for evaluation of the propensity toward or relative freedom from damage might be had through an arbitrary schedule of overstressing. A specimen could be run for some definite fraction of the life it has shown at some definite overstress as a virgin bar, then be run at a lower stress, i.e., at the endurance limit or only at slightly above the endurance limit. The behavior at this lower stress, compared with the behavior of a virgin specimen, will show whether the specimen was or was not damaged. Some such damage data exist, and are collected[11] but few have been obtained on such a schedule as to be thoroughly comparable with each other.

In spite of the importance of finding

out how different steels and different heats respond to notches and overloads, and of improving behavior in these respects, avoidance of fatigue failures in improved materials, as in the everyday materials of engineering now available, will still require the engineering expedients of avoiding notches and utilizing controlled cold-working of the surface.

One engineer[13] discusses this as follows:

"Fully 90 per cent of all fatigue failures occurring in service or during laboratory and road tests are traceable to design and production defects and only the remaining 10 per cent are primarily the responsibility of the metallurgist as defects in material, material specification, or heat treatment.

"Study of fatigue of materials is the joint duty of the metallurgical, engineering, production department. There is no definite line between mechanical and metallurgical factors that contribute to fatigue. This overlapping of responsibility is not sufficiently understood.

"Hence the engineers are constantly demanding new metallurgical miracles instead of correcting their own faults. Until metallurgists are less willing to look for metallurgical causes of fatigue and insist that equally competent examination for mechanical causes be made, we cannot hope to make full use of our engineering material."

(To be continued)

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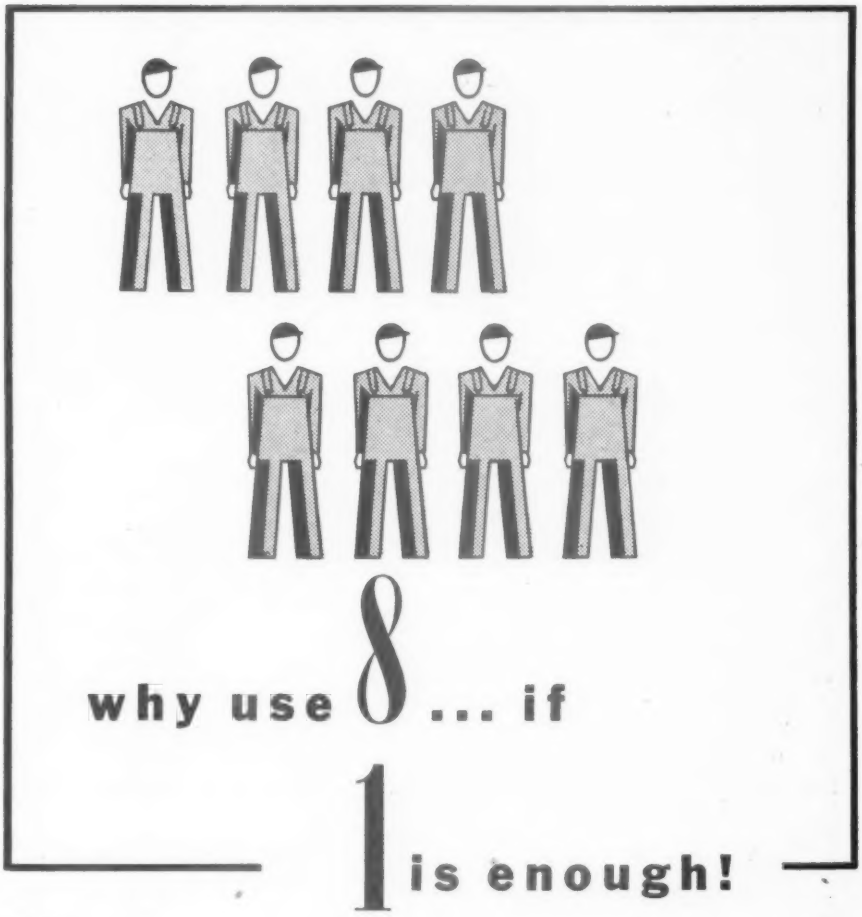

Men, Men, MEN! Your molding foreman cries for molders. Chipper and grinders are urgently needed in your cleaning room. Coremakers are at a premium in the core room, and sand piles are awaiting strong backed men. It is next to impossible to find sand shovelers in such a labor market. BUT . . . WHY LOOK FOR 8 If 1 IS ENOUGH?

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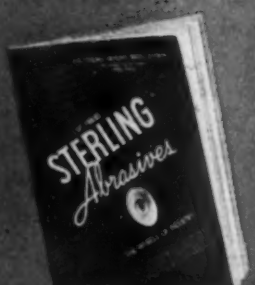

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THE WHEELS OF INDUSTRY

FOUNDRY DEVELOPMENTS
At short range

USE of sawdust is not new as many references occur in literature to its application for improving venting properties and permeability. More recently sawdust has been used in green and dry sand molding to overcome scabbing and buckling, and the Sands Subcommittee of the Institute of British Foundrymen decided to examine the possibility of using wood dust or other wood waste as a substitute for coal dust in foundry sand mixtures, primarily to assist the national effort for fuel conservation. Material used was wood dust graded to remove all material coarser than about 30 mesh. Application was to light and medium castings, and actual average ratio of wood dust to coal dust used on equivalent mixture by three investigators was 3.7, 4.01 and 4.25 to 1. It was found that the additions reduced green compression strength of the sand mixture about 15 per cent; plasticity or deformation is increased, and in general there is a tendency to increase permeability with continued use. Dry strength is not materially affected by small additions, but additions on the order of 5 to 7 per cent wood dust appreciably reduce dry strength. With continued use rate of deterioration of sand is reduced, and economy in new sand should follow. In general no appreciable difference can be observed with light or medium gray iron castings as regards surface finish or general character. However, it is doubtful whether superfine finish can be produced without coal dust in green sand molding.

◆ ◆ ◆

ONE foundry engaged in centrifugal casting of steel uses gray cast iron molds which are protected against the cutting action of the entering molten steel by use of a core opposite the gate. The iron for the molds contains about 3.2 per cent total carbon, 2.10 per cent silicon, 0.85 per cent manganese, 0.100 per cent sulphur, and 0.100 per cent maximum phosphorus.

◆ ◆ ◆

FROM time to time references are made to possible applications of supersonics, which are vibrations or waves with frequencies higher than those that affect the human ear. The most recent suggestion tried in Germany was for obtaining finer grain in castings by subjecting the molten metal during solidification to supersonic radiations which is said to have broken up the crystals. Another application was in the production of a self-lubricating bronze containing 25 per cent graphite. It is claimed that under supersonic vibrations the graphite is finely dispersed in the molten bronze, resulting in a homogeneous mixture. Supersonic generator consisted of a nickel-iron tube a few centimeters long magnetized by a high frequency current tuned to be in resonance with the harmonic of the natural longitudinal frequency of the tube. It is claimed that frequencies of the order of 12,000 per second are generated.

◆ ◆ ◆

CONCLUDING phase of an extended investigation of the 85-5-5-5 alloy concerned with the effect of gaseous atmosphere during melting was conducted by Gardner, Krynitsky and Saeger. Atmospheres of hydrogen, nitrogen, methane, carbon dioxide, carbon monoxide and air were used, and sand cast and chill cast bars were made as well as hollow cylinders for pressure testing. It was found that no significant changes occurred in chemical composition with the different gases. For both types of bars melting under hydrogen and methane was most detrimental on physical properties. In hydraulic testing it was found that the "skin" of the casting was important in obtaining superior resistance to leakage. Running quality of the metal as determined by spiral casting was not affected by the different atmospheres. A high degree of unsoundness (voids) was found to be characteristic of metal melted under hydrogen.

◆ ◆ ◆

JUST before the war, according to our British contemporary, *Metal Industry*, a new bronze plating process was perfected in the laboratories of the Tin Research Institute by which a highly decorative alloy coating consisting of about 40 per cent tin and 60 per cent copper can be deposited on other metals. Known as white bronze or speculum plating, it can be applied directly to copper and other nonferrous alloys; with steel a thin undercoating of nickel is desirable. In appearance the coating closely resembles polished silver, being less blue than chromium and less yellow than nickel. It retains its luster indefinitely in indoor use, and is resistant to alkaline solutions and moderately resistant to acids. In particular the coating is unaffected by fruit juices, milk, vinegar and beer, and is not tarnished by traces of sulphur. Applications include those for tableware, bathroom fittings, kitchen and culinary ware, electrical fittings, window and door furniture, etc.

◆ ◆ ◆

GRAIN refinement in aluminum casting alloys can be accomplished through the addition of 0.10 per cent columbium or 0.15 per cent titanium, and is of particular value when pouring thin section or intricate castings at higher than usual temperatures. In the case of columbium, it is reported that an aluminum alloy containing the amount mentioned was held at 900 degrees Cent. (1650 degrees Fahr.) for 4 hours without impairing the grain refining effect of the additions.

◆ ◆ ◆

RECENT reports indicate that styrene is being employed in place of tung oil, which is hard to obtain, for impregnation of magnesium alloy castings showing leakage under pressure testing. Styrene is a yellowish, oily liquid better known as a raw material for synthetic rubber production and making polystyrene resins. Like tung oil the styrene must be polymerized to form a solid, and that is accomplished by use of benzoyl peroxide.

◆ ◆ ◆

THE U. S. Office of Education, Federal Security Agency in co-operation with the War Manpower Commission has prepared a "secret" training weapon which places war industry workers on the production line in one-fourth to one-third less time. The shortcut to war production is a new type of training film which is said not only to cut training time, but also substantially to increase retention of what is taught. At present 150 of the new 16 millimeter sound-picture films are available on a self-liquidating basis. Detailed information, index and prices on the training films may be secured from Harry J. Coleman, Castle Films Inc., 30 Rockefeller Plaza, New York. E.B.

DETERMINING ALLOY COMPOSITION

(*Concluded from page* 112)

sion is made to 1 gram, and a dilution of 500-25-500 cubic centimeters; as all photelometer readings are based on that weight and dilution. From 50 to 99 is approximately the accurate range of the scale.

For determination of nickel dissolve sample in a suitable flask with 26 cubic centimeters of perchloric acid. Remove and dilute to required volume in a volumetric flask and pipette exactly 25 cubic centimeters of this solution into the proper size volumetric flask.

Add in order given: 10 cubic centimeters of citric acid; 5 cubic centimeters of bromine water; 5 cubic centimeters of ammonium hydroxide, and 3 cubic centimeters of dimethylglyoxime. Shake well after each addition. Dilute to required volume and read in the photelometer, using the green filter.

Solutions required are: Perchloric acid; 10 per cent solution of citric acid; saturated solution bromine water; ammonium hydroxide (1 to 1), and 1 per cent dimethylglyoxime in ethyl alcohol.

For a 6-minute determination of manganese the solution of the sample is accomplished directly in the volumetric flask. Sample weight is varied according to Table III. Then 20 milliliters of perchloric acid is added and boiled until steel is in solution and heavy fumes of perchloric acid hover over mouth of flask. The presence of chromium in amounts greater than 0.50 per cent is destroyed by the addition of sodium chloride, introduced by the aid of a stainless steel spatula. From 0.25 to 1 gram should accomplish the complete vaporization of chromium as indicated by the absence of further brown fumes on the addition of more sodium chloride. The solution is boiled for an additional short period and removed from the hot plate. Without cooling 20 milliliters of potassium periodate solution is added and color immediately develops. Flask is diluted to calibration mark without cooling, then agitated and a portion transferred to the photelometric cell after which reading is taken from the photelometer. The percentage of manganese is readily obtained from a previously prepared curve.

The standard curve is established by using Bureau of Standard steel samples in varying amounts of manganese for each step in percentage.

Solutions required are: Perchloric acid 60 per cent technical. Periodate stock solution composed of 24 grams potassium periodate dissolved in 1000 milliliters nitric acid (sp. gr. 1.20). Working solution of potassium periodate is composed of: 800 milliliters stock solution; 700 milliliters phosphoric acid, and 550 milliliters water.

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Apprentice Training Plans Described

Four new pamphlets related to apprentice training have been prepared and are being offered by the Apprentice-Training Service, Bureau of Training, War Manpower Commission, Washington. One entitled "The Wartime Program of the Apprentice-Training Service" describes activities of the service in assisting industry to meet manpower needs through both short-term training and apprenticeship systems. The other three pamphlets detail training programs followed by the Westcott Valve Co., East St. Louis, Ill.; Armco Drainig & Metal Products Inc., New Orleans, and the Holfast Rubber Co., Atlanta, Ga.

Stoker Inspection

Two new check charts for single-retort and multiple-retort stokers are being offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mounted on 16 x 21-inch cardboard, the charts are designed to make regular and thorough inspection of stokers easy.

MAKES THE MOST OF FLOOR SPACE

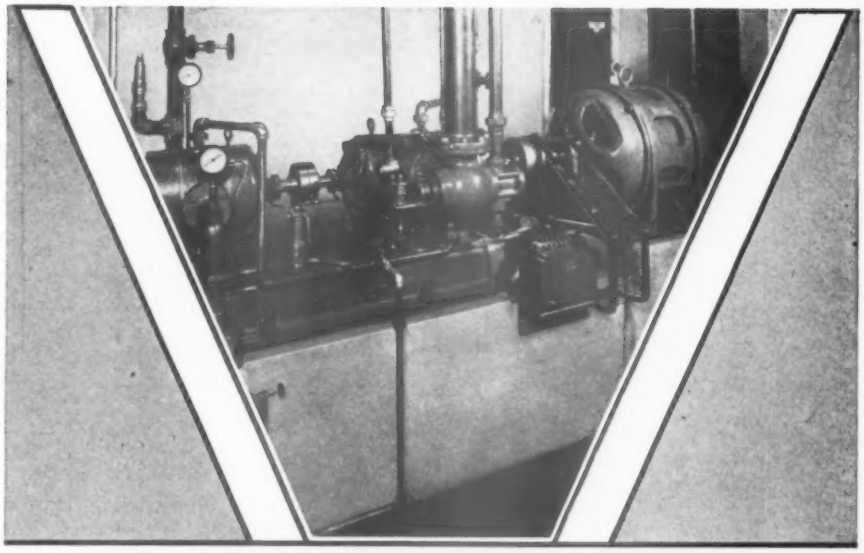
(*Continued from page* 108)

Each loaded buggy in turn is pushed along the track to the vicinity of the furnace where it remains for a short time, or until the furnace has been emptied and is ready for another charge. Three chains on the crane are attached to three ears or loops on the loaded trough which now becomes a chute. The open end is inserted in the charging doorway. The two front hooks are released. When the crane lifts the back end of the chute, the charge of miscellaneous material slides on to the furnace hearth. The empty chute is replaced on the buggy and returned to the vicinity of the stock pile for another load. Sequence of operation is continuous, since the furnace runs steadily night and day, with tapping periods less than 2 hours apart.

Determine Metal Condition

When the heat has been worked down approximately to the tapping stage, the melter inserts a long rod with a spoon-shaped depression at the end. The spoon first is covered with a coating of slag, which adheres to the surface, and then is pushed further through the slag covering and into the steel bath. The spoon then is withdrawn and the contents poured into a small test mold. By observing closely the manner in which the metal flows, the melter gages the temperature and viscosity. By cooling the test block in a water tank, breaking it in two with a sledge hammer and observing the character of the fracture, he can estimate the carbon content and decide whether or not the heat has reached the tapping stage. If the fracture appears satisfactory to the melter he then pours a test bar in a permanent mold and inserts it in the carbanalyzer which indicates the accuracy of the carbon content of the steel. Competency in this branch of the art is gained only through practice and experience.

Several tests may be taken during the progress of the heat. The final test block is taken to the laboratory where drillings subjected to the usual treatment indicate the percentage of various elements present. A report based on the analysis forms part of a permanent record on all heats. On alloy steels, and on plain carbon steels made to close specifications, the permanent record also shows the tensile strength, elongation, facility in bending and any other specified physical properties. The laboratory is located next to the plant office and is equipped to carry on routine analysis of all incoming raw materials, sand conditioning, etc., in addition to the quick tests on heats before they are tapped. The laboratory is considered a highly essential factor in the expressed company policy of meeting exactly customer requirements and of making a reasonable



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AND PEACE-TIME PRODUCTION

Fuller Rotary Compressors are doing their part in a big way to win the victory and, after that, they'll still be on the firing line for peace-time production. They're working day and night in cement and steel plants, foundries, shipyards, alcohol, aircraft, and chemical plants, gas and oil refineries. They're built to take it and performance records prove their worth.

One plant engineer in a war industry writes: "It is now approaching the third year of continuous operation for your two-stage compressor, (1800 C.F.M., 100-lb. pressure), during which time we are glad to report that the service load factor has been in the neighborhood of 99.9 per cent."

FULLER ROTARY COMPRESSORS

Another — "Your two-stage compressor, (100 C.F.M., 90-lb. pressure), has run 23 hours per day almost continuously for four years and has given no trouble." Not a cent was spent for repairs during these four years.

In a foundry — during three years' operation only $3.90 was spent for repairs on a two-stage compressor. (330 C.F.M., 100-lb. pressure).

Performance such as this will help to gain a more speedy victory. And, after that, they'll still give you many years of efficient performance at minimum operating expense with capacities maintained for the life of the machine.

C-87

FULLER COMPANY

CATASAUQUA—PENNSYLVANIA

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profit on every transaction. The company believes that the customer is entitled to the best. It also believes that the laborer is worthy of his hire and that no business can be conducted successfully unless both buyer and seller are satisfied. The management does not claim originality for the idea, but finds the application quite satisfactory.

The molding and pouring department occupies approximately half of the foundry floor space, with a battery of molding machines along one side. Long lines of roller conveyors are in the center and a core room, 24 x 100 feet, is in a side bay on the opposite side. Small cores are made on benches and larger cores are made on the floor. Sand hoppers above the benches are replenished from tote boxes suspended from one of the cranes. Similar boxes bring sand to the floor coremakers. The cores are loaded on racks and dried in a battery of gas fired ovens. The dried cores are removed and distributed to the various molding stations as required.

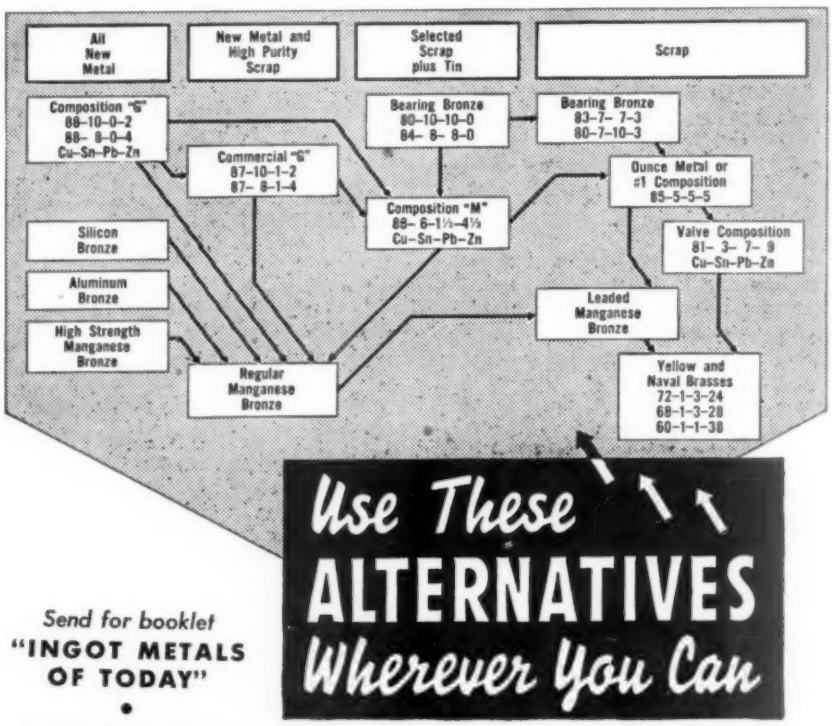
Occasionally and under special circumstances, loose patterns are employed, but in the great majority of instances the patterns are mounted on boards. The company maintains a pattern shop, but constructs few new patterns. Nearly all the work is confined to adapting existing customer patterns to standards which have been established as the result of practical experience. The right to exchange the size, position and number of gates and risers is left to the discretion of the foundryman. The foundryman takes the sensible view that he knows better than any ousider what kind of a pattern is necessary to produce a good casting. Quite properly he insists—if necessary—in making certain changes which in his opinion will result in a perfect casting instead of a waster. His opinion is based on long practical experience, and he knows what is and what is not within the range of practical accomplishment.

Battery in Long Line

Medium size and large molds for castings weighing up to 3000 pounds are made under a stationary type sand-slinger located in the main bay at the south end of the foundry. The completed molds are assembled and poured on the floor in the vicinity. Other odd jobs in the intermediate weight range are made on a jolt rollover machine, set up near the center of the floor and treated in a similar manner. Volume of castings produced in this section of the foundry amounts to approximately 10 per cent of the total. Molds for the remaining 90 per cent and in considerable variety of shapes and sizes are made on a battery of jolt squeeze machines arranged in a straight line near one side of the foundry and supplied with sand from overhead hoppers provided with control gates at the bottom.

As the molds are made they are placed on roller conveyor lines extending into the main bay. Some of the conveyor lines are single on which individual flasks follow each other. Others are double and spaced about 4 feet apart. Long planks riding on these double conveyors and extending a foot or more beyond them on either side, support five molds made in snap flasks and reinforced by slip jackets. Weights are placed on the copes of the small molds and shifted in the usual manner to succeeding molds after those in the front rank are filled with metal. The larger flasks are clamped. Some of the clamps are tightened with wedges, while others with an eye at one end and a long hooked toe at the other end are tightened automatically when the cam action toe engages the trunnion on the drag flask. The eye engages the trunnion on the cope.

Conveyors are mounted on a slight grade so that molds readily may be moved in one direction. A small transfer car with a section of roller conveyor on top and running on a track in front of the molding machines, facilitates delivery of the molds from any machine to any one of the main conveyor lines. The molding department works only one 8-hour shift and during that time produces enough molds to absorb all the metal melted not only in the day, but also at night. The conveyors have sufficient capacity to meet this requirement. Immediately after each batch of molds is filled with metal, the molds are taken to a central area and shaken out. The castings are taken to the rough cleaning floor and the empty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NOTE

*"Proper Melting Decreases Foundry Losses," contains interesting data. Also, the booklet, "Nonferrous Ingot Metals of Today." Write for both of these. They are free.

Notice how the arrows on the W.P.B. chart point to the *right*. . . . They show how alternative materials *currently available* can be utilized by foundrymen as now permitted by many designers. The purpose is to conserve primary metal at the mine through increased use of secondary ingots. Sometimes great ingenuity is called for, yet remember this:

The first program for scientific control of ingot metal was set up by Ajax 45 years ago. The result has been metal and practical technical follow-through in which Ajax increases your production by reducing rejects.

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flasks are placed on a roller conveyor and returned to the vicinity of the various molding machines where they are again placed in service.

Inspection of castings begins when they are shaken out of the molds and is continued through all the subsequent stages of operation to the shipping dock. Adequate light on the cleaning and chipping room is provided by side windows and by skylights in the roof. Heads and gates are removed from the castings with acetylene torches and then the castings are placed on roller conveyors leading to various pieces of cleaning equipment. The small castings are loaded in batches into a blasting machine where they are tumbled about and subjected to the action of abrasive material thrown against them centrifugally with great force. A skip hoist is employed to load the blasting machine and a second load is made up while the first load is going through the cleaning process. At the conclusion of each cleaning cycle, the direction of the rotating barrel is reversed and the cleaned castings fall automatically into a tote box on wheels running on an industrial track. Large castings are cleaned in a pressure blast chamber where the abrasive material is driven against them by compressed air. Gate and head stumps, fins, etc., are removed by stationary and swing grinders.

Plain carbon castings are loaded on a car and placed in a gas fired annealing furnace where they are raised to a temperature of 1650 degrees Fahr., held at that temperature for approximately 1 hour per inch of metal thickness, and then allowed to cool. Alloy steel castings destined for special service are given suitable heat treatment to impart the necessary physical properties.

Book Review

Essentials of Industrial Health, by Dr. C. O. Sappington, 626 pages, published by J. B. Lippincott Co., Philadelphia. Price $6.50.

War has emphasized even more the great importance of protecting the health of industrial workers. Shortages of manpower have driven home the fact that production can be increased materially where well organized health programs reduce the amount of absenteeism due to sickness and disability through accident or causes resulting from working conditions. For these reasons, this book is especially timely and should prove of exceptional value to all of those engaged in industrial management. The author is one of the leading authorities in the field, a consultant industrial hygienist, president of the Central States Society of Industrial Medicine and Surgery, and editor of *Industrial Medicine*.

The work is divided into three parts, with the first section devoted to industrial health administration. This traces the origin and later development of industrial health work; occupational morbidity and mortality; distribution of industrial health service; and organization of the industrial medical department. The second section, concerned with industrial hygiene and toxicology, discusses industrial health exposures; the plant survey; plant sanitation and hygiene; personal hygiene for workers; and co-ordination of industrial and community health. The third section considers industrial medicine and traumatic surgery under the headings of the worker and the job; industrial accidents; occupational diseases, nonoccupational disabilities and workmen's compensation and rehabilitation.

Orders for Foundry Equipment Rise

Orders for foundry equipment jumped sharply in December to the highest level since last April, according to the Foundry Equipment Manufacturers Association. The association's index of total sales for the month was 442.8, compared with 388 in November, 382.5 in December, 1942, and 562.7 in March, 1943, the peak of last year. Most of the December upturn was accounted for by new equipment, repair orders showing little change from November.

A. F. Holden Co., New Haven, Conn., has received the Army-Navy "E" star for its plants at New Haven and West Haven.

PLANTS NOW MELTING ALUMINUM ALLOYS ELECTRICALLY ENJOY THESE SPECIFIC ADVANTAGES...

1. VASTLY INCREASED PHYSICALS (tensile strength and elongation) in foundry, die-cast, or rolling mill products.
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5. ELIMINATION of oxide inclusions.
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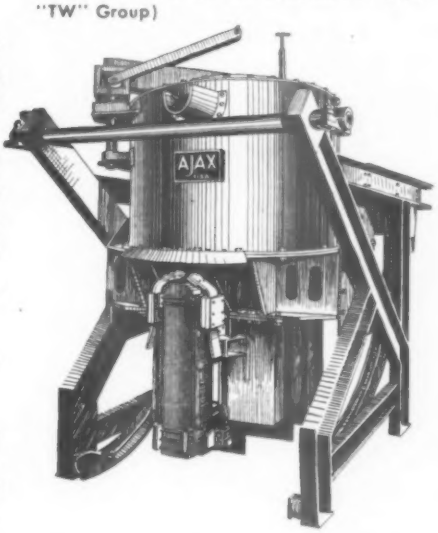
7. DELIVERY of the rated production per hour on the hour, (production capacity 300 lbs. to 1250 lbs. per hour).

This is the first commercial electric furnace for melting aluminum alloys in continuous operation. It utilizes the famous Ajax-Wyatt low-frequency induction melting principle which has been applied successfully for nearly all wrought brass melted throughout the world. Write for new bulletins . . . (The "TW" Group)



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AJAX ELECTRIC CO., INC., The Ajax-Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax-Wyatt Induction Furnaces for Melting

FOUNDRY ACTIVITIES

HERCULES Foundries Inc., Los Angeles, has disposed of its equipment and assets to a group of industrialists who will build a new plant in the Los Angeles eastern industrial area for the manufacture of plumbing supplies, at a cost of approximately $1,000,000. The group includes: Lawrence A. Harvey, chairman of Harvey Machine Co. Inc.; Alex Deutch, president of American Screw Corp., and Louis Earschaw, president of Warmac Co. Victor Halperin will be in charge of research and sales.

° ° °

Dodge Steel Co., Philadelphia, received the Army-Navy "E" at ceremonies held Jan. 18. The pennant was presented by Rear Adm. Thomas B. Richey to Clarence Tolan Jr., company president. John Tarka and Florence Vernon, the oldest Dodge employes, and Clayton McKonly and Charles J. Fileshifter, union representatives, received "E" pins as representatives for the company's 621 employes.

° ° °

Lakey Foundry & Machine Co., Muskegon, Mich., is erecting a service building and addition to its foundry at an estimated cost of $343,000, including machinery and equipment. Strom & Strom Construction Co., Muskegon, has the contract for the building work.

° ° °

Saginaw Malleable Iron Division, General Motors Corp., Saginaw, Mich., has placed a contract with Austin Engineering Inc., Detroit, for an addition to its processing building. Estimated cost is $19,500.

° ° °

C. Lee Cook Mfg. Co., Louisville, Ky., has been awarded the "M" pennant of the United States Maritime Commission. The company manufactures metallic packings and piston rings for ship engines.

° ° °

Howell Foundry, Whittier, Calif., is erecting a 30 x 50-foot plant addition to cost $2000.

° ° °

Akron Bronze & Aluminum Co., Akron, O., plans a one-story addition 60 x 100 feet and 50 x 140 feet, also interior alterations.

° ° °

Centrifugal Castings Corp., 524 Front Avenue N. W., Grand Rapids, Mich., has been incorporated with $50,000 capital to manufacture centrifugal castings, by Ernest R. Olsen, 134 Union Avenue N. E.

° ° °

Dedman Foundry & Machine Co., Houston, Tex., has been bought by the Federal Steel Products Corp., Dallas, Tex.

° ° °

Aluminum Foundry & Pattern Works, 4 St. Philippe street, St. Laurent, Montreal, Que., plans construction of a plant addition to cost about $20,000.

° ° °

Standard Foundry Co., Racine, Wis., has let contract for a one-story plant addition.

° ° °

Dependable Foundry & Mfg. Co. is the firm name under which William T. Haislip has published an intention to conduct business at 1720 East Fourth street, Los Angeles.

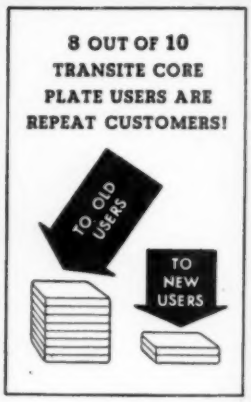
° ° °

Star Foundry & Machine Co.'s plant at New Lexington, O., was destroyed by fire Jan. 10, involving a $40,000 loss. The company made gray iron and nonferrous castings.

° ° °

Klamath Machine & Locomotive Works, Klamath Falls, Oreg., plans rebuilding and resumption of operations as soon as possible at its foundry which burned recently.

USERS COME BACK FOR MORE!



IT'S EASY to figure out why—once they give Johns-Manville's Transite Core Plates a try—eight out of every ten experienced operators keep coming back for more and more. Here are the answers:

Light Weight: Transite Core Plates are far lighter than metal. More can be carried in one load.
Less Breakage: Their fibrous nature provides unusual shock resistance, minimizes breaking and cracking.
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Non-Warping: Metal plates have a low warpage tolerance. But Transite Core Plates are even lower!
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For full details, write for Brochure PP-10A. Johns-Manville, 22 East 40th Street, New York 16, N. Y.

JM Johns-Manville
TRANSITE Core Plates

CASTING IN PLASTER MOLDS

(*Continued from page* 99)

smooth. Sides of the flask have to be rough enough to hold the plaster mold while it is being removed from the pattern. If the sides are smooth a ½-inch dowel stick can be split and each half fastened to the sides of the flask to hold the mold firmly in the flask. The type of flask recommended is illustrated in Fig. 4. It has perpendicular sides with grooves in the sides to hold the mold firmly in place until released by opening the flask.

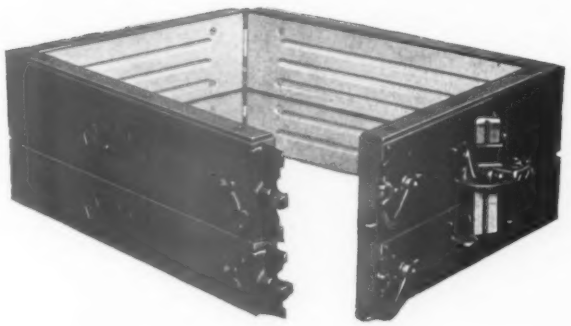


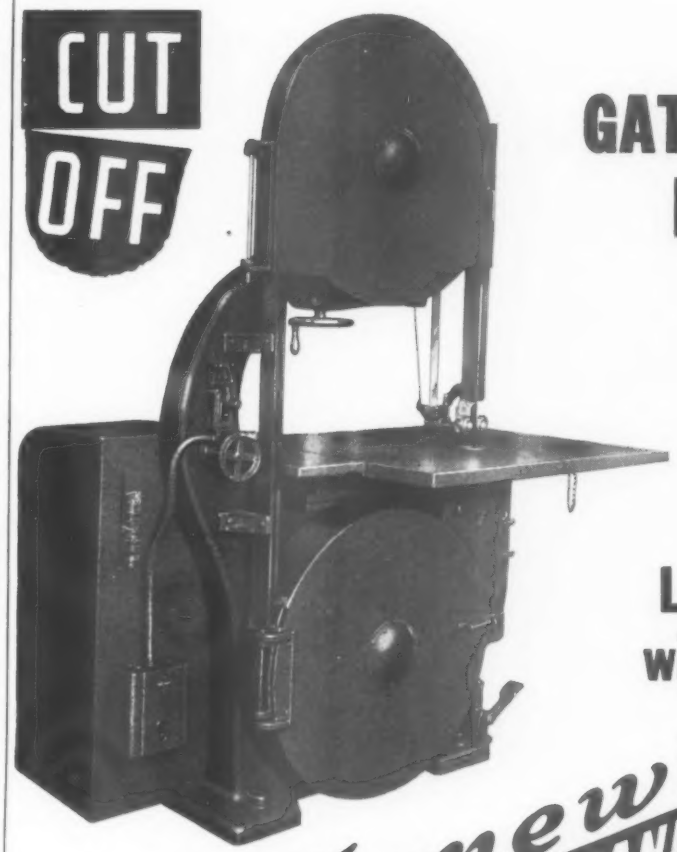
Fig. 4 — Snap flasks with parallel grooves in the sides will permit lifting the mold from the pattern without danger of slipping

Guide pins should be attached either to the plate or to the flask, with guides set tight enough that when the flask is lifted off the plate it must be lifted straight away until the mold has cleared the pattern completely. If there is any play in the guide pins that will allow one end of the mold to be raised higher than the other end as the flask is lifted off, the pattern will, of course, damage the soft mold. While wood flasks are not recommended for the plaster process because of the susceptibility to warping, cherry flasks have been used successfully in experimental work where great production was not required. The ideal flask would be magnesium alloy or aluminum.

The use of good oil-wax parting is absolutely essential to the success of this process, and several proprietary compounds are available. These partings may be sprayed or brushed on the pattern. Best results are obtained by using a very thin coating.

Metal casting plaster should be mixed with fibrous talc. The ratio is 4 pounds of metal casting plaster to 1 pound of fibrous talc. This will be satisfactory for small operations where the mixing time is not critical. For speeding up the mix 1 pound of terra alba should be added for each 100 pounds of metal casting plaster to accelerate the set of the plaster. The addition of the terra alba makes no difference in the finished product but does speed up the mixing time as well as the setting time.

This dry mixing can be done with any good dry mixing equipment. A good home-made mixer can be made by suspending a box on a shaft and nailing a few baffle boards in it. This should be equipped with a tight fitting lid and can be rotated by the use of a small motor. It is necessary that the dry ingredients be mixed thoroughly but this is not difficult. The length of time necessary to mix the ingredients thoroughly will depend on the efficiency of the mixer but, since mixing is not difficult, this part of the process should not take more than 10 minutes. It will take roughly 1 pound of dry mix for each 48 cubic inches of space in the flask including the space occupied by the average pattern. A flask



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10 x 12 inches filled 2 inches high would contain 240 cubic inches and would require 5 pounds of dry mix.

Wet mixing can be done by hand but a mechanical mixer is to be preferred. There are several good mechanical mixers on the market that are operated by ¼-horsepower motors. Mixers should be operated at high speed. The type of mixer recommended is shown in Fig. 5. The mixer is sturdy and will stand continuous use without overheating. It does a good job of mixing in a short time and, since it operates at a high speed, will reduce the mixing time to a matter of less than a minute. The mixing vessel should be higher than it is wide. For an ordinary 12 x 16-inch flask a 12-quart galvanized pail is satisfactory. A dish pan or flat vessel should not be used. The ingredients should always be weighed and 1.7 pounds of water, preferably warm, should be used for each pound of dry mix. This will give a permeability in the finished mold of about one third the amount of an ordinary sand mold, but this is sufficient since the metal may be poured slowly and the amount of gases generated is small.

The dry mix should be added to the water, and never the water to the dry mix. After the water is weighed the proper weight of dry mix should be added to the water and the mixture stirred until it starts to cream or thicken. Length of mixing time will depend on whether any accelerator has been used, on the purity of the water, on the temperature of the water and on the speed of the mixer. Once the proper mixing time is determined this time should be constant so long as all of these factors are constant.

As soon as the wet mix starts to cream it should be poured into the flask rapidly, being careful not to trap large air bubbles on the surface of the pattern. Vibrating the flask will aid in dislodging any bubbles that may have been trapped. If the materials have not been mixed long enough the heavy particles will have a tendency to settle to the bottom of the flask which would be on the face

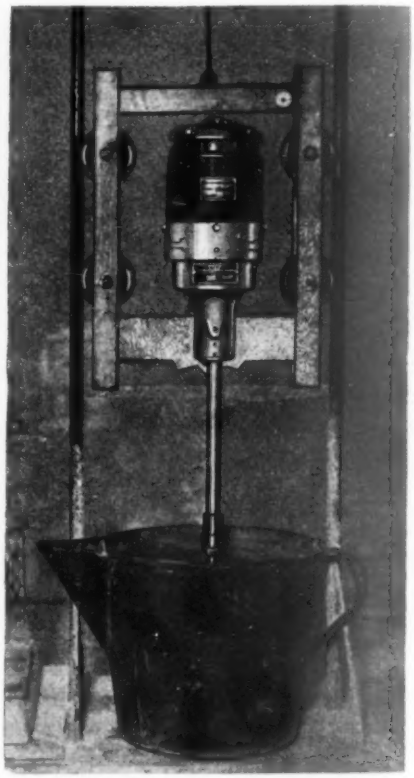

Fig. 5—While mixing may be performed by hand, a mechanical stirrer provides a uniform mixture in much less time

of the mold. This will result in a heavy face and a light back and the mold will warp while it is being baked. If the mixing has continued too long the trapped air will not escape since the mixture will be so thick it will hold the air against the pattern. With a mechanical mixer there is a danger of mixing the plaster entirely through the set. In other words, the material can be mixed until it starts to set and then crystallization is broken up so that the set is completed without the crystals having joined. In this case a wet creamy mass will result which will not set.

After the wet mix has been poured into the flask, it should be allowed to set until the mold is firm. This will be from 15 to 30 minutes depending on the time at which the wet mix was poured into

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Many of America's most progressive foundries are meeting today's demands for an ever increasing tonnage through a wider use of portable grinders. Frequently, this calls for "common-sense" changes in their portable grinding wheels—changes which may involve new sizes . . . new shapes . . . different grains . . . different grades.

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DAYTON GRINDING WHEELS

the flask. When the mold is firm the flask should be lifted straight off the pattern. The flask should be opened and the mold removed. The mold then should be placed immediately in an oven on a flat grid.

When the proper mixing time has been determined, it is highly desirable that this time be controlled with some automatic timing device. If care is exercised in weighing all of the ingredients in the dry mix, weighing the amount of dry mixture and weighing or measuring accurately the water for each batch, timing the mixture, and keeping the water at the same temperature, then uniform molds may be secured without the use of experienced or skilled labor.

It is necessary that the baking oven be provided with grids to hold the mold and provide circulation of air under the mold as well as on top. The mold should be laid in the oven with the face or pattern side up. The oven should provide a temperature of at least 600 degrees Fahr. and may go as high as 1300 degrees Fahr. Radiant heat is desirable but not necessary. The oven should bring the mold up to the desired temperature rapidly, but should allow it to cool to 300 degrees Fahr. before removal to prevent cracking when the mold is exposed to room temperature.

Prefer Continuous Oven

A heat treating oven using high speed forced circulation is not desirable. It is difficult to place the molds in the oven so that there will be an even circulation on both sides and when the moisture vapor is removed rapidly from one side and not from the other, the molds will warp. Continuous ovens that will receive the molds at one end and discharge the baked molds at the other are highly desirable. The oven should be well insulated to conserve fuel and to facilitate the maintenance of temperatures within the oven.

A continuous kiln of the pottery type would be satisfactory for this purpose. If a periodic core oven is used for the production of molds, the oven should be filled, then brought up to its highest temperature rapidly and maintained at this temperature long enough to bake the molds thoroughly. Then the temperature is reduced gradually to 300 degrees Fahr. before the door is opened. Some means must be provided to allow the moisture vapor to escape.

Length of time the molds should be in the oven depends on the temperature, the circulation, and the ease with which the moisture vapor is removed from the oven. A mold 12 x 16 x 3 inches should be baked sufficiently for brass, bronze or aluminum at 600 degrees Fahr. in from 8 to 10 hours. At 1300 degrees Fahr. the molds should be baked in 2½ hours. For magnesium castings the temperature should go to at least 1000 degrees Fahr. and should be continued for a longer period than for brass, bronze and aluminum. It is absolutely essential that not only the added moisture be removed from the molds, but also that the molds be calcined thoroughly and the water of crystallization driven off. The molds should be used soon after they are removed from the oven as they might absorb moisture from the air on standing.

Cores may be made of the same mixture that is used for making the molds, and the same rules apply. Coreboxes should be made of the same material that is used for making patterns and should be coated thoroughly with the same liquid parting. When the cores are removed from the coreboxes they should not be laid on conventional core driers which do not permit the circulation of air completely around the core. They should be placed on grids and baked in an oven. They may be reinforced with wire the same as sand cores.

When the cope and drag are removed from the oven they will seem very fragile to foundrymen who have been handling sand molds. They are fragile, but if handled carefully, little loss will be sustained. If necessary to obtain proper directional solidification, chills and chaplets may be used. For small castings, thumb tacks or conventional chills may be pushed into the soft plaster. Cores should be laid carefully in place and any dust removed from the face of the drag by lightly blowing with compressed air.

Locating pins should be inserted in the proper holes in the drag and the cope fitted on. If they have been made

Milwaukee Chills have passed the rigid inspection of foundrymen who demand the best. These Chills have been improved to accelerate cooling, insuring sound castings free from internal shrinks and surface checks. They will also prevent molten metal from cutting into the sand. These Chills will cut scrap losses, and reduce welding and cleaning costs.

Ask for samples and prices on Milwaukee Thread Stem Chaplets . . . . Standard Radius Chills . . . . Schmitz Chaplets . . . . Patented Adjustable Radius Chills . . . . Other Chaplets and Foundry Supplies.

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and baked properly the cope and drag will fit together without any difficulty and without any space between them for the metal to run through. No flask is used around this completed mold. It is placed on a plate with weights placed on top of it heavy enough to withstand the pressure when the metal is poured. At least 40 pounds should be used on a mold 12 x 16 inches.

A pouring sleeve fitted into the sprue or set over it is recommended to give the advantage of hydrostatic pressure. This sleeve may be made of a pipe filled with metal casting plaster with a hole through the center or it may be made of core sand or of a refractory material. For magnesium alloys this sleeve should simply be an iron pipe large enough to fit into the sprue. For copper alloys the pouring sleeve should be from 6 to 8 inches high, for aluminum from 8 to 10 inches high and for magnesium alloys 24 inches high. Better detail can be obtained in brass, bronze or aluminum by increasing the height of the pouring sleeve, but in general practice this is not necessary.

In general, the metal does not need to be as hot to cast in plaster molds as when casting in sand molds, but since there is no fixed rule as to the proper pouring temperature, it must be determined by experimentation. The metal should be poured slowly, and all of the rules of good foundry practice should be followed regarding the use of fluxes and the cleanliness of crucibles and ladles. Since metal casting plaster is a good insulator, the casting should be allowed to stay in the mold for a much longer period of time than in a sand mold of a corresponding size.

Castings can be shaken out on a vibrating screen which will shake most of the plaster loose. Any plaster still adhering to the castings can be removed with a stream of water under high pressure. If there is a film on the castings, indicating a slight reaction between the metal and the mold, this can be removed with a revolving metal brush.

While practically any nonferrous metal can be cast in plaster molds, some are more adapted to this process than others. Aluminum is ideal. All standard copper alloys work well that contain at least 0.5 per cent aluminum, beryllium or silicon. The 85-5-5-5 alloy reacts slightly with the mold and has a thin film on the surface that is easily removed. Magnesium alloys in general use cast well in plaster molds. Care must be taken to be sure that every bit of moisture is removed from the molds, and they should be purged by pouring some sulphur dioxide down the pouring sleeve. This gas is heavy and will expel the air ahead of the metal when the magnesium is being poured. Magnesium castings should show a uniform surface hardness of not less than 72 on the B scale. At present the limit of pouring temperature is 2400 degrees Fahr.

This general foundry process should not be used for casting zinc-base alloys for dies. Plaster patterns and molds are ideal for such dies but the molds are made by a different process.

New Saw-Gun Saws and Files in Hard-to-Get-At Places

Jobs of sawing and cutting that are inaccessible to ordinary tools, are now made possible with the recently developed Saw-Gun. It works equally well on wood, plastics, light and heavy gauge metals (corrugated or plain—stainless and monel), castings, rods and other materials. The Saw-Gun saves hours on panel notching and slotting operations, doing work ordinarily requiring the use of several tools.

It is propelled by electric power, compressed air or flexible shaft and provides an efficient portable power-saw or file, that can be carried from place to place.

The Saw-Gun is operated by placing cutting edge of saw blade against work and turning on power. Filing is accomplished in the same manner by inserting a file in the tool instead of a saw blade.

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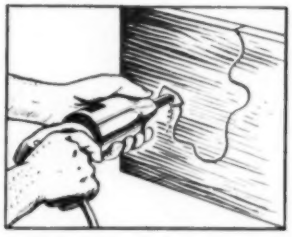

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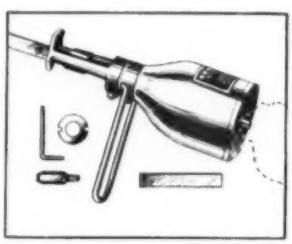

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Y-105

Heat Treating Group To Advise WPB

An industry advisory committee of the heat treating equipment industry recently was formed by the War Production Board. With Dr. Bradley Stoughton of the WPB Tool Division as government presiding officer, it consists of the following members: Frank H. Adams, Surface Combustion, Toledo, O.; Stanley N. Juthe, American Electric Furnace Co., Boston; William Adams Jr., Ajax Electric Co. Inc., Philadelphia; Carl F. Mayer, Carl Mayer Corp., Cleveland; W. E. Benninghoff, Ohio Crankshaft Co., Toledo, O.; P. C. Osterman, American Gas Furnace Co., Elizabeth, N. J.; R. F. Benzinger, Electric Furnace Co., Salem, O.; Ralph W. Porter, Swindell-Dressler Corp., Pittsburgh; P. L. Gear, Amsler-Morton Co., Pittsburgh; Cary T. Stevenson, Lindberg Engineering Co., Chicago.

Metal Industry, 22 Henrietta street, London, W. C. 2, England, recently published the 1943 edition of its "Metal Industry Handbook and Directory". It contains 472 pages devoted to information and data on nonferrous metals and alloys.

HEAT TREATING BRONZE CASTINGS

(*Continued from page* 109)

Gas can be generated in cores that contain too much organic binder which forms excess gases during burning. When the vents are small or missing these gases escape into the metal. When a core is not thoroughly dry, steam is generated when metal is poured around it and if the vents are poor, steam escapes into the metal and forms tiny pin holes. Wet molding sand will generate steam and produce pin holes or blows on the surfaces of the castings.

Some alloys are more susceptible than others to oxidation. Some are harder than others on mold and core surfaces. Several methods are available for coping with these difficulties. The metal must be oxidized properly. Phosphor-copper usually is added to the red bronzes. This deoxidizes the metal, promotes fluidity, and toughens some alloys. If the metal is very drossy from oxidation, the furnace atmosphere should be controlled, and a dross or oxide dissolving flux should be used. If the oxides and dross cannot be eliminated, the gate should be designed to choke or trap these before they enter the casting. Choke gates, strainer cores, or running the metal up hill are usual methods of accomplishing this. Good melting is an important factor.

Good Sand Necessary

Scabs or sand washes frequently cause porosity. Only good sand conditioning and control can overcome these defects. Good permeability, strength and minimum moisture content are desirable for the production of sound castings.

Leakage in bronze castings may be caused by one or more elements which promote unsoundness in the metal. Aluminum is the most common. It forms a greasy oxide film, which tends to remain in the metal. If there is lead present, the aluminum causes it to be thrown out of suspension. Aluminum should not be present even as a trace.

Silicon is another treacherous metal for pressure castings. In an alloy it reacts similarly to aluminum and positively must be avoided.

Iron, if present over 0.25 per cent, is dangerous to pressure castings, and spoils the appearance. Iron in these bronzes will not alloy over a certain small percentage. Iron in larger quantities blackens the metal, makes it brittle and forms hard spots (probably iron carbides) in the castings. Also, it has a tendency to burn into mold surfaces and cores.

Antimony, if present in quantities over 0.25 per cent, is detrimental to pressure castings. It makes them brittle, spoils the elongation and tensile strength of the metal, and we believe it is a definite cause for structural formations that cause leakage. This will be discussed further in the details of heat treatment.

Arsenic is another material rarely found in these bronzes in any large percentage. As with antimony, we believe it is very harmful to bronzes and causes

Melting conditions should be such as to prevent absorption of gases

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A wide variety of castings is made in the author's foundry

a peculiar change in the structure.

Metals are heat treated for several purposes: To relieve stress or strains caused by different working or cooling forces; to refine or rearrange the grain structure; to harden or toughen the alloy. The first two reasons apply to leakage in pressure castings. Stresses and strains of differential cooling are removed, and a grain refinement is made.

This heat treatment is nothing more than annealing, a process known for many years and practiced extensively in iron and steel foundries.

Consider a casting of any metal produced in accord with first-class foundry technique. Metal is clean, mold and core are satisfactory and well made, the casting is fed properly. In all probability, if the sections are uniform throughout, the casting will be sound.

If the sections are not uniform in thickness, and if the design is poor, the casting will develop stresses and strains due to uneven cooling. The core or mold will influence rate of cooling by acting as chilling surfaces. The outer skin will solidify rapidly, while the heavy sections will remain in the liquid state for a longer period of time. Stresses of differential cooling will take place, and the casting will remain permanently in a stressed condition.

Bronze and copper alloys are more resistant to shock than is cast iron. But they have these same forces present in the structures. Removal of these stresses and strains should be considered as a matter of great importance.

Affect Crystal Structure

The authors have reason to believe that impurities affect the crystal structure. For example, one ingot lot with an analysis of 87.6 per cent copper, 5.9 per cent tin, 4.2 per cent zinc, 1.7 per cent lead, and containing 0.01 per cent arsenic and 0.23 per cent antimony was used to produce pressure castings. The test bars failed on the elongation tests in several cases. The tensile strengths in most cases were above 34,000 pounds per square inch, but the elongation sometimes was as low as 12 per cent. A number of castings made of this metal leaked under pressure. They were salvaged by annealing. The castings appeared sound, and when sawed through the leaky section, they showed no sign of porosity. This seems to indicate that impurities cause a certain unusual or different crystal formation or grain growth.

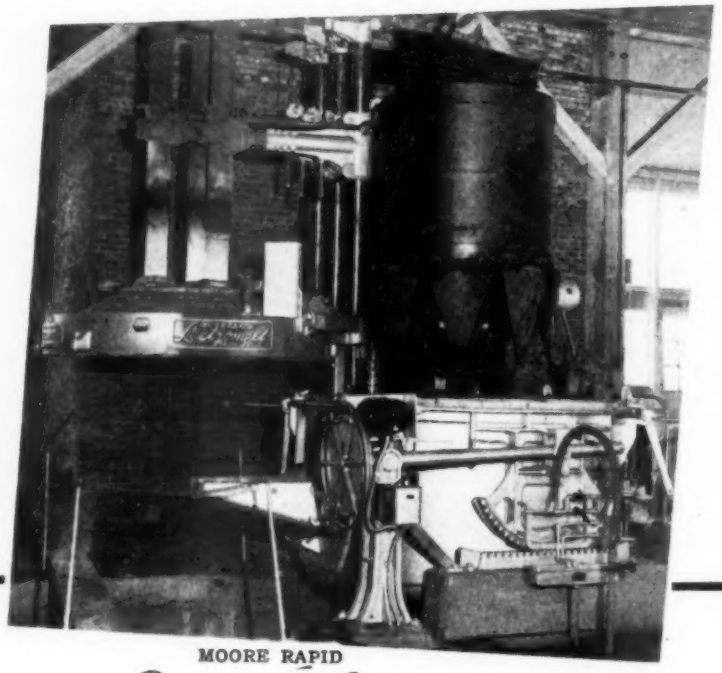
To see if ordinary physical properties were affected by heat treatment, an experiment was made on test bars. Four bars and five valve castings were poured from a heat of valve bronze. Two bars were machined from the rough test bar castings. Two others were annealed and then machined. On pulling the bars, results were nearly the same for all bars, as shown in the accompanying table.

Test Bar Comparisons

	Ultimate Tensile Strength, psi.	Elongation Per cent in 2"
No. 1, as cast	38,000	28.00
No. 2, as cast	40,700	38.00
No. 3, annealed	39,200	20.50
No. 4, annealed	38,250	27.50

All four bars were cast under wedge type feeding risers. The as-cast bars were fed with maximum metal, and probably were not subject to differential

Reduce The Time From Heat to Heat



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cooling. Therefore they were not stressed or strained. Heat treating or normalizing had no effect. Appearance of the structure under a magnifying glass was improved slightly and was more uniform in the heat treated samples. The matrix of the annealed structures was slightly redder than that of the as-cast samples.

In one instance a number of valve body castings proved to be leakers after machining, assembling, and testing. Several castings cut through the leaking sections and inspected with a magnifying glass showed no indication of gas, shrinkage or tearing. The castings appeared sound in every respect. Most of them leaked through the inner diaphragm, the section of metal supporting the valve seat in a globe valve. Some leaked through the bodies, some through stud holes in the flanges, and some through the threaded sections of screw type valves.

These dendritic leaks show definite characteristics. Where air pressure is applied to a valve chamber, and the casting filled or submerged in water, the leak will not be apparent for several seconds. The bubbling caused by the leakage will continue for some time after the pressure has been released and exhausted from the valve chamber. In leakage due to cracks, tears, or dirt, the leak is apparent immediately after applying the pressure, and stops immediately on removal of the pressure.

Pressure Castings Leaked

Experiments along this line were prompted by an item in the *Questions and Answers* department of the November, 1943, issue of THE FOUNDRY, in which a certain foundry had trouble in producing similar castings. This article mentioned annealing at 1400 degrees Fahr. for several hours.

We experimented first with two valve bodies, weighing about 35 pounds each. Both castings leaked at the diaphragm and one had a stud and body leak. The castings were annealed for 2 hours at 1400 degrees Fahr. After annealing, the castings were sandblasted, the seats refinished and then assembled and tested. One casting was satisfactory, the other casting leaked at a flange on the body. This leak was definitely a tear or crack from poor foundry practice.

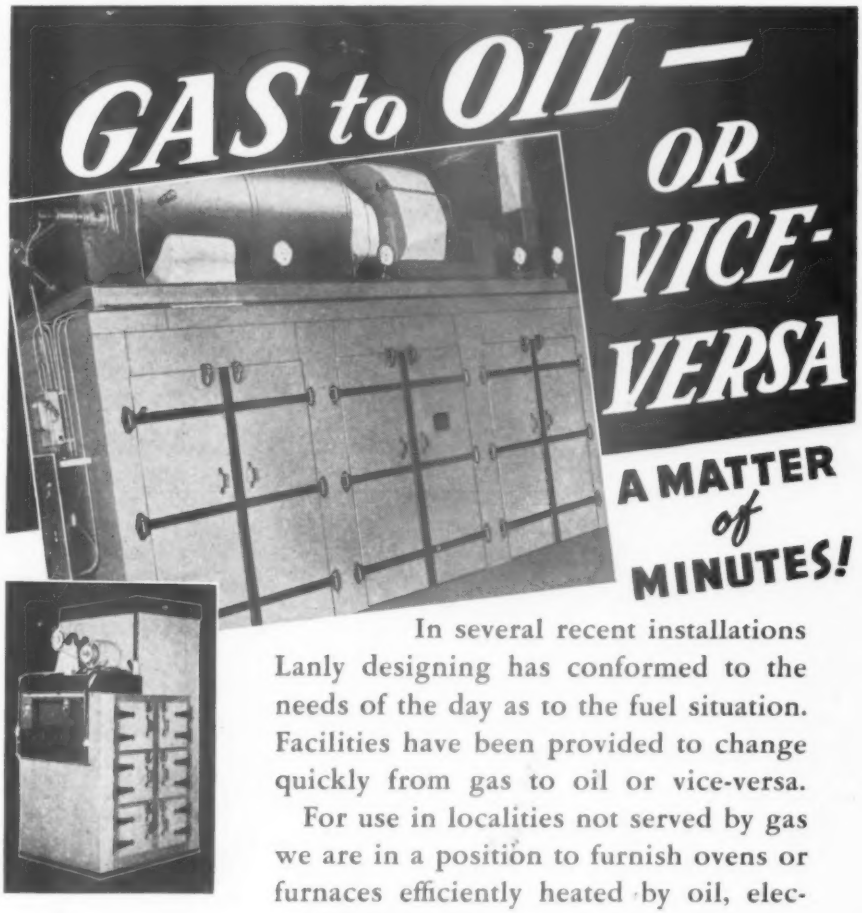
We next tried 25 valve bodies of the same size that had been rejected because of body, diaphragm, and stud leakage. Out of 25, 21 were satisfactory and passed the stiff inspection after annealing for 2 hours at 1200 degrees Fahr. Two of the four that were found porous after the first annealing were annealed again at the same temperature and for the same length of time. They were found satisfactory after the second treatment. One of the remaining two was full of blowholes, and the treatment had no effect; it leaked like a sieve. Since all of the 25 castings had been rejected because of porosity, this annealing salvaged 92 per cent of the leakers.

A number of high-pressure valve bodies tested at 450 pounds per square inch and rejected because of porosity were annealed at 1200 degrees Fahr. for 2 hours. All 23 castings were found satisfactory, and ultimately over 90 per cent of 150 valves that were rejected originally because of leakage, were saved.

After this discovery we started to anneal rough castings before the sandblasting operation, and the percentage of leakers in body castings dropped in some cases from as high as 50 per cent down to a normal 3 or 4 per cent. These normalized castings not only do not leak, but they are stronger, closer grained, and have no interfering forces in the structure. The annealing process will not cure foundry defective castings. Only castings with sound structures can be saved.

Gray Iron Founders Plan Meetings

Gray Iron Founders' Society Inc. is planning two regional meetings, one March 22 at Hotel Statler, Boston, and the second March 24 at Hotel Pennsylvania, New York. Each will be a one-day meeting, starting at 9:30 a.m., with the program consisting of discussions of topics connected with foundry management, and sales.



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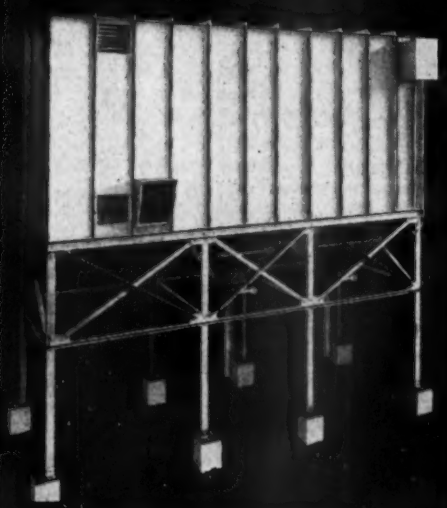

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FACTORS IN MAKING QUALITY CASTINGS

(*Continued from page* 115)

stresses over a wide area. They have been used rather extensively and their function is to solidify earlier than the sections they adjoin and act as a bond to prevent hot tears and cracks.

4. Use of thermal nonconductive molding materials.

5. Pouring from elevated temperatures.

6. Casting design.

In some foundries all castings, large or small, are poured on the dull side. If the metal is hot it is chilled by adding scrap to the ladle. However, when the iron in one foundry was increased in temperature and poured hot for pressure castings, the machine shop losses from leakers, shrink, dirt and spongy metal dropped so suddenly that it served as conclusive proof that hot pouring was essential to pressure type castings. In fact, the improvement in the machine shop was so marked that hot pouring was adopted as regular practice for all classes of castings.

Does Not Favor Dull Metal

Dull pouring, that is, pouring near the freezing temperature, brings about a quick freezing of the skin of the casting by heating up the cold mold, but does not provide the necessary temperature difference between metal and mold to establish a proper temperature gradient when freezing is approached. Thus the interior of the casting cools relatively slowly. Pouring temperatures which are too low, even if sufficiently high to avoid cold shuts, may not permit risers to perform their primary function of feeding the casting or of carrying off slag, dirt and dross.

Casting temperatures which are too high, aside from increasing liquid shrinkage and quite apart from other disadvantages, reduce the rate of solidification, because the excess heat of the metal is communicated to the mold before the freezing point of the metal is reached. The resulting gradual solidification produces not only a coarse structure, but promotes serious segregation. Controlled pouring temperatures therefore are desirable in the manufacture of quality castings.

Shrinkage also varies with the composition or the solidification range of the metal. Carbon and silicon are important factors and any considerable change in either of these will so alter the shrinkage that modification in gates and feeders becomes necessary to insure complete soundness in the casting.

Composition of the metal must be in balance. An iron thrown out of balance by either a high silicon or carbon content will produce an open porous structure, particularly in heavy sections.

Solidification range of the metal, the temperature at which the metal is poured, as well as the surface area and size of the gates, affect shrinkage. Often we hear a foundryman claiming that a low-temperature iron will prevent internal shrinkage, and on the other hand we often hear another state that high temperature will prevent internal shrinkage. It is possible that both of these statements are correct but apparently other important controlling conditions have not been stated.

Where the shrinkage section is far removed from the ingate, metal of a low temperature will eliminate shrinkage, because the metal is near the solidification point. By reducing the area of the gate, we can pour iron so that it will be dull and near its solidification point by the time it reaches the section of high shrinkage.

Another method of eliminating shrinkage is to place this section near a heavy gate. Hot iron entering the heavy gate often will eliminate this shrinkage because it will then act as a feeding riser.

Effect of Pouring Speed

Another factor of prime importance is the effect of pouring speed. Theoretically it is possible to pour a casting without risers if the rate of pouring, design of the casting and temperature of the metal are correct. This "rate of pour" is a critical value, and deviations from the exact rate will result in one of two conditions. If the rate is too high, shrinkage will be found. If the rate is too low, the outside of the casting will show laps or cold shuts and other defects, such as scabs and pockmarks. If the rate of pouring is kept as low as is practical, the riser may be diminished and soundness improved. However, this does have certain disadvantages.

The scabbing of the cope can be remedied by: Faster pouring; a more thorough nailing of the cope surface; an increased use of crabs or gaggers in the cope; a change in the sand mixture.

If heavy sections are located in inaccessible places where risers cannot function, the use of chills must be resorted to. These may be used either externally or internally. A chill will equalize the rate of cooling in the different sections and produce a more uniform freezing rate in the casting, thereby preventing porosity.

An external chill shaped to the contour of the casting accelerates the cooling and solidification of that part of the casting affected. An internal chill, usually a piece of rolled metal of a composition similar to that of the casting to be poured, is placed in relatively heavy sections of the mold so that the liquid steel surrounds it completely and in so doing accelerates the cooling and solidification of the metal at that point. Often chills are placed in cores to equalize the cooling rate on a heavy section.

If external chills are too small they do not balance the cooling, while if too large they are apt to cause small surface cracks. Experience and good judgment are necessary in selecting the correct size of chill to maintain this balance. Chills must be thoroughly clean to prevent undesirable chemical reaction with the molten steel. If molds containing chills are not poured reasonably soon after closing, the chills are apt to condense moisture and become rusty. When this occurs the liquid steel will not lie quietly against the chills, and defective castings may be produced.

A common expedient to strengthen sections susceptible to concentrated contraction stresses is the use of triangular brackets of relatively light metal section joining the flange in the body and spaced equally around the casting. These brackets solidify early and have much greater strength than the more plastic metal in the sections affected by a cooling lag during this critical period. The removal of these brackets is an expensive cleaning operation and the result detracts from the general appearance of the product.

Several of the more important methods used to obtain solid quality castings are shown in the accompanying illustrations.

1. *Gating System* — As indicated in Fig. 1, the actual points at which molten metal enters the mold often provide an excellent means for directing solidification. Of the three fundamental classes of gates (top, parting, and bottom) only the first two are capable of producing

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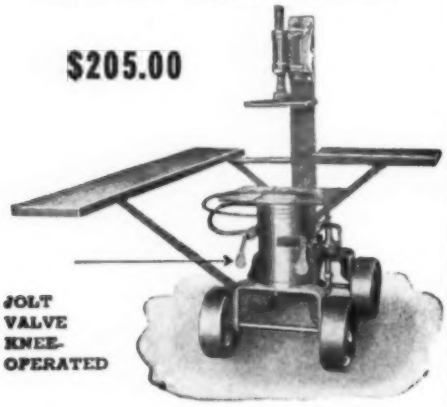

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favorable temperature gradients. They do this by virtue of their elevated location. All other things remaining equal, the portions of the casting farthest from the gate will freeze first, and the freezing will tend to be directed from those portions toward the gate. Thus a gate situated at or near the top of the casting will direct solidification up to itself, while a gate situated at the bottom of the casting will direct solidification down to itself. The direction in the latter case is counter to that required for efficient feeding.

Bottom-gating, despite the adverse temperature gradients it creates, enjoys the greater popularity among foundrymen. It is regarded as being the orthodox method for gating castings. The reason for its widespread popularity is its ability to introduce metal into the mold with a minimum of disturbance.

2. *Riser Pouring*—Two rather approved methods for obtaining sound castings are direct riser pouring as shown in Fig. 2 and indirect riser pouring, as illustrated in Figs. 3 and 4.

In direct riser pouring the casting is poured directly through the riser, while in other cases the metal is poured through a sprue which enters the riser

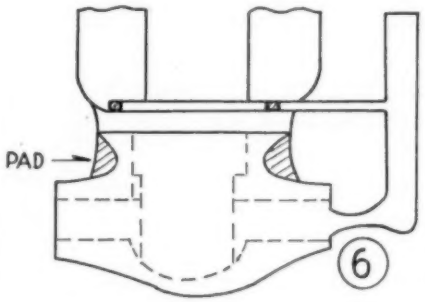

Fig. 6—Padding for controlled directional solidification

before it enters the mold cavity. As stated previously directional solidification of the casting from the bottom of the mold to the top is assured by the cooling of the first metal to enter the mold and progressive cooling to the riser at the top. Advantages of riser pouring include economy in yield, and lower pouring temperatures. In indirect riser pouring the solidification of the metal is also directed to the riser. To obtain directional solidification the mold may be placed either horizontally or at an incline; it may also be rocked. After pouring, this type of gating does not play such havoc with the mold materials.

3. *Total and Partial Reversal Pouring*—Wherever flat surfaces are obtained the mold usually is tilted, as shown in Fig. 5, or it may be tilted and reversed to obtain directional solidification. In gating castings of this type the riser size can be reduced to some extent. The method often requires special rigging equipment.

Unfortunately, the reversal systems are not applicable to all manner and

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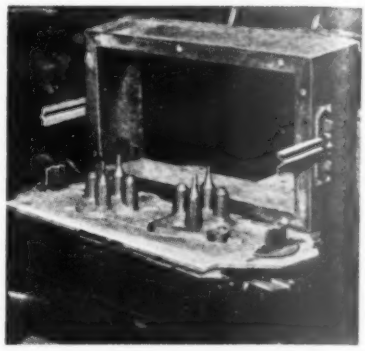

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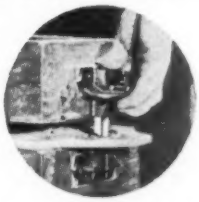

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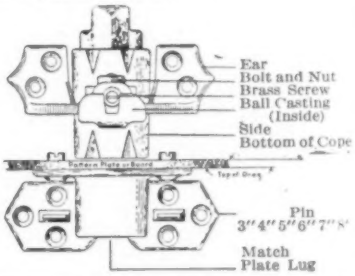

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sizes of castings, and their range of usefulness has been limited. Huge molds containing from 10,000 to 30,000 pounds of liquid steel cannot be reversed easily with promptness and safety, but this does not preclude the use of the principle of controlled directional solidification on large castings. Favorable temperature gradients can be imposed upon them.

4. *Padding*—For large castings it is the usual procedure, wherever possible, to pad the mold to obtain proper solidification, as shown in Fig. 6. However, this will increase the finishing cost. In certain types of castings a persistent shrink always was found. Substitution of external pads for external chills aided greatly in the production of sound castings.

5. *Step Gating*—Step gating often is resorted to in the pouring of large cylinder type castings to obtain directional solidification and eliminate sponginess which frequently results when all the

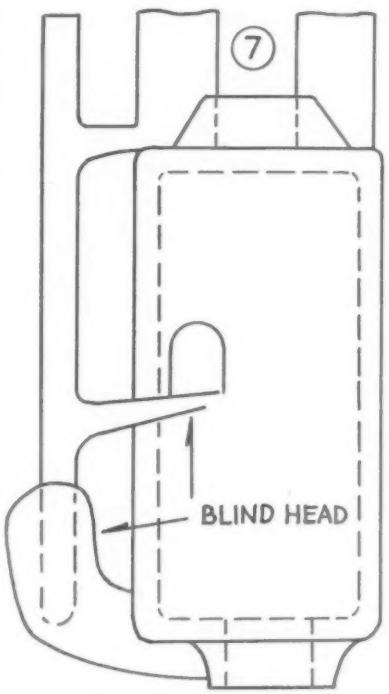

Fig. 7—Illustrating method of step gating

metal runs through the bottom and is forced to the top of the mold. An example of step gating is illustrated in Fig. 7.

6. *Atmospheric Pressure Influence*—Another method of risering castings, shown in Fig. 8, is to place a refractory material or core in a blind riser so that atmospheric pressure is always acting upon the liquid metal in the center of the riser. There are certain advantages of this method: It causes a minimum of mold erosion; frequently this type of risering can be located more rapidly in the mold with respect to the section to be fed; it often affords an increased yield.

7. *Knife Gating*—This method of gating is not relatively new but does possess some excellent advantages, particu-

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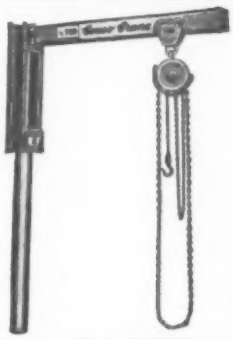

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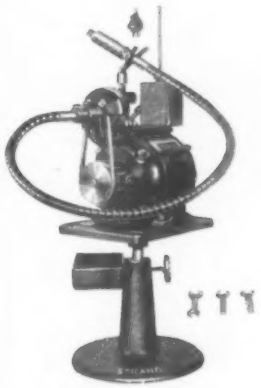

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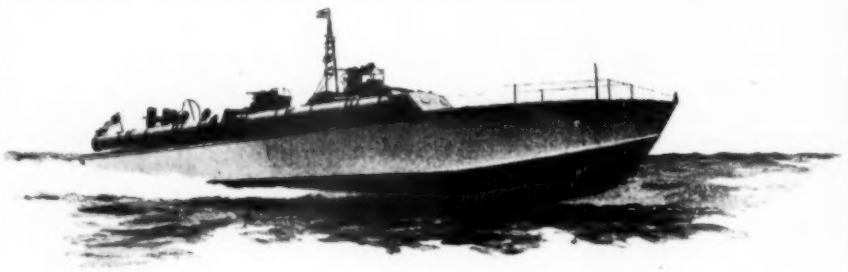

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larly in the casting of flat plates. This type of gating is generally poured downhill or vertically.

Belief in the necessity of a riser on every mold still persists but mass production methods have helped to explode that tradition. Gray iron risers can be reduced to a minimum and often eliminated by properly controlling the flow of metal through the gating arrangement. In one foundry melting over 500 tons of iron per day not a single ounce of it goes into a riser. That is merely offered to show what systematic co-ordination all along the line, design, pouring, temperature, composition and gating, can accomplish.

Individual problems in shrinkage often must be solved by a given set of circumstances which surround the casting. For example, consider a soft iron casting in regular production having an abrupt change in section ⅜ to 2½ inches. Solidity was essential in this heavy section because a lubricated shaft was placed through that section. If shrinkage occurred it would collect chips in machining and under forced lubrication not only would cause excessive wear on the shaft but would impair the lubrication of other parts of the machine.

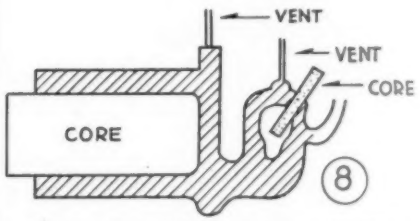

Fig. 8—Atmospheric pressure feeding

The gating arrangement could not be changed because of flask equipment, and the composition of the iron could not reasonably be changed because of machining speeds set by the engineering department. Neither could the design be changed. Furthermore, this heavy section was located in an inaccessible place where a riser could not function properly. The shrinkage cavity finally was remedied by a localized chill placed in the core which produced a closer grain iron but still retained its easy machining qualities. Consequently, in this case as in many others force of circumstances dictates the method to be used in eliminating shrinkage cavities.

Entrained slag in the metal also requires attention if perfect castings are to be produced. Often it is observed when the heats are quite cold that considerable slag accumulates in the ladle, and is rather difficult to remove. Metal of this kind shows aggregates of slag when poured into castings.

To overcome a slag condition of this kind it is necessary to restrict or choke the flow of metal at some point in the gating system so that the down gate can be kept full during the pouring operation. It also may be remedied by placing a slag or dirt catcher to restrict the flow of metal between the sprue and the

mold cavity. These are only precautionary measures—the real solution is to melt the iron properly.

A rigging practice file should be maintained by the foundry to provide a record of information necessary for the satisfactory reproduction of castings.

The file also functions as a reference for the gating of new castings and as a check to insure the complete inspection of pilot castings. It should include:

1. Floor location; type of sand; overall dimensions of casting.
2. Section thickness.
3. Location of ingates, whether handcut, loose pieces or mounted with pattern.
4. Area of ingates at casting, location of choke.
5. Location and size of downsprue.
6. Location and type of any dirt skim devices, dam gates, skim cores, etc.
7. Location and size (including height) of risers.
8. Area of riser pad and distance of riser from casting.
9. Location of chills; type of chill coating.
10. Size and type of flask.
11. Special details, pouring on downhill slope, use of carbon cores, nailing of copes for added strength or the use of special sand for the same purpose, use of shrinkage relief blocks (as in pipe castings), location of metal inserts or bushings, etc.
12. All other important data.

(*To be continued*)

Adventures of Bill

(*Concluded from page* 139)

against a heavy beam under the roof. Believe me Bill, there was one casting that wasn't going to get away by the time we got through turning on those jacks. If it did get away, it would have to raise the roof. Well, Bill, I was there until four of those pots were made and they were all slickers.

I could tell you more foundry stuff, but I guess I'll wait until some other time. In case you want to let Pat Dwyer print the story in THE FOUNDRY I am enclosing 2 bits for a copy. I am going to subscribe regular again as soon as I know whether or not I am going to stay for a while where I am now.

I always get a kick out of the "Adventures of Bill" and the *Tales From the Gangway*. I want to say that *Gates and Risers For Castings* is truly one of the most valuable books on practical molding ever written. I hope some day the editors of THE FOUNDRY will get around to indexing and publishing in book form the wealth of information in the Question and Answer department. If some of the supers and gaffers I have run into here and there would read this stuff and knew how to apply it, foundries would run a lot smoother.

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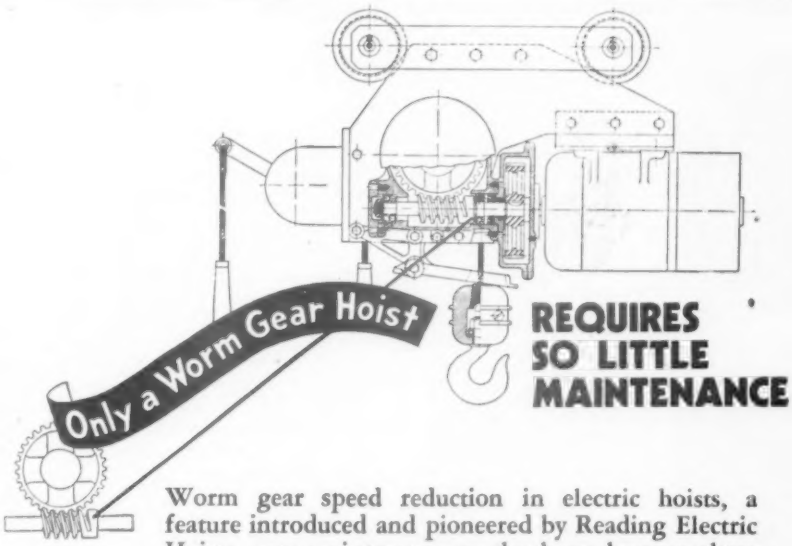

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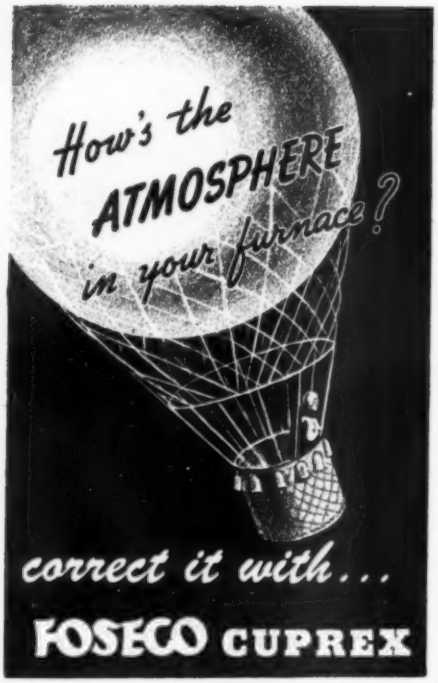

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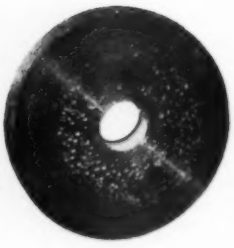

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BUTTERFLY VALVES—Manual and power operated valves for pressures ranging from 15 to 900 pounds per square inch are described and illustrated in a 36-page catalog No. 14-B recently issued by the R-S Products Corp., Wayne Junction, Philadelphia 44.

VACUUM CLEANING—Central vacuum cleaning systems for industrial plants and buildings of all types are described in a new bulletin D 4, issued by Allen Billmyre Co., 431 Fayette Avenue, Mamaroneck, N. Y. The bulletin outlines benefits of this type of cleaning system, explains the special features and details of the equipment.

WELDING — The Eutectic Welding Alloys Co., 40 Worth Street, New York 13, has issued a revised version of its "Technical Data Book" which embodies the latest experiences, developments and research work in the various fields of application of the Eutectic low temperature welding process. Also it gives data on the Eutectic alloys and their corresponding fluxes.

CIRCUIT BREAKER—Catalog 1002 obtainable from the I-T-E Circuit Breaker Co., 19th and Hamilton Streets, Philadelphia 30, includes sections covering the selection and construction of low-voltage air circuit breakers.

DUST CONTROL—American Foundry Equipment Co., 654 South Byrkit Street, Mishawaka, Ind., has issued a new folder describing and illustrating its Dustube dust collectors. The device is supplied in a wide range of sizes and in three types for handling air volumes from 270 cubic feet per minute up.

MOLDING MACHINES—A compact 26-page catalog recently issued by the Champion Foundry & Machine Co., 1314-16 West 21st Street, Chicago, and listed as Reference Catalog No. 15, describes and illustrates the wide range of molding machines produced by this company. Auxiliary and related equipment includes valves, riddles, equalizers, push-off devices and four types of core blowing machines.

GATE CUTTER—A folder recently issued by the DeWalt Products Corp., Lancaster, Pa., describes a new machine designed for cutting gates and risers from nonferrous castings. The operator can make cuts from any angle, with the casting mounted on the table or on the floor. The arm may be rotated right or left 360 degrees and the motor may be located at any position on the arm.

HYDRO-BLAST BARREL—Whiting Corp., Harvey, Ill., has issued bulletins describing and illustrating several items in a wide range of equipment for the foundry and other industries. The following bulletins are available upon application: FY-106, hydro-blast barrel; FY-104 side blow converter; FY-102, impact pulverizer; FY-101 mechanical charging systems; and a folder on pulverized coal firing of billet heating furnaces.

CHAIN BELT DRIVES—"War Time Care of Chain Belt Drives" is the title of a booklet issued by the Chain Belt Co., 1600 West Bruce Street, Milwaukee 4, Wis., and available upon application. The booklet presents information on the maintenance, lubrication and repair of chain belts.

DUST COLLECTOR — Bulletin No. 910, recently issued by the Pangborn Corp., Hagerstown, Pa., describes features and construction specifications, also capacities and dimensions, of a new industrial type unit dust collector in three sizes. Of particular importance is the flexibility of arrangement permissible for adaption to specific plant conditions.

BAND FILING—A bulletin describing the construction, operation and application of bands for file broaching on metal, wood and plastics has been published by Continental Machines, Inc., 1301 Washington Avenue, South, Minneapolis.

HEAT TREATING — Literature recently published by the Surface Combustion Co., Toledo, O., includes a booklet "The Heat Treating Furnace, Yesterday, Today and Tomorrow"; a folder describing standard rated furnace units; another folder containing description and illustrations of car bottom furnaces; and another folder dealing with furnaces for melting and subsequent heat treatment of light metals.

GRINDING WHEELS—Specifications for grinding wheels for speed, accuracy, precision and high production are presented in a bulletin issued by the DoALL Co., Des Plaines, Ill. Additional literature in the form of folders and booklets issued by the same company covers: Steel ink, cutting oils, soluble oil, band saw lubricant, abrasive bands, surface grinders. This material is available either in separate form, or combined in an attractive 20-page illustrated booklet.

MASONRY SAWS—Why it pays to use Clipper masonry saws in industrial plants is the subject described and illustrated in a folder recently issued by the Clipper Mfg. Co., 4030 Manchester Avenue, St. Louis. It is claimed the saws are widely used by refractory manufacturers and the consuming industries for cutting clay, silica, chrome magnesite, sillimanite, etc.

FLUXES—American-British Chemical Supplies, Inc., 180 Madison Ave., New York, has issued a folder on "Foundrates", described as practical preparations for protecting and purifying molten metals. The material is available in 17 different combinations for application to all classes of ferrous and nonferrous metals.

BLAST TABLE—Bulletin 99, issued by the W. W. Sly Mfg. Co., 4700 Train Avenue, Cleveland 2, with text and illustration describes an airless blast machine in which centrifugal force is utilized to give the abrasive material the velocity needed to do an efficient job of cleaning by force of impact.

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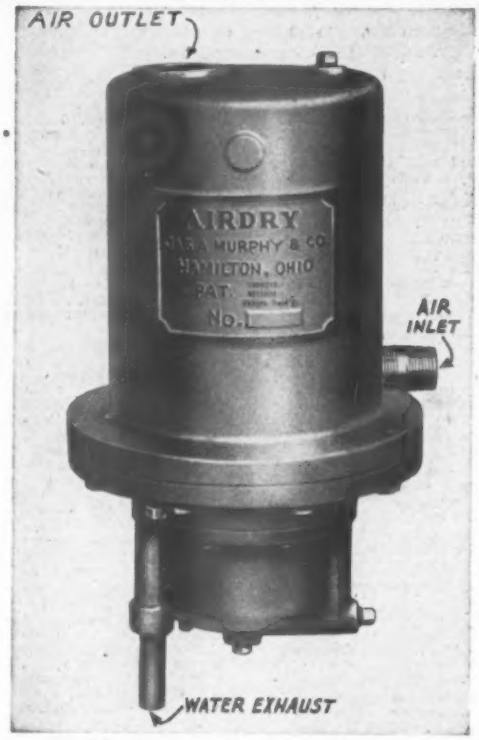

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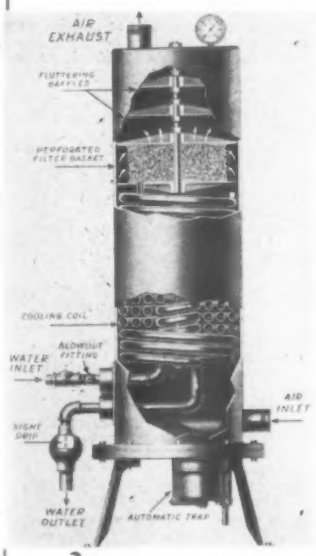

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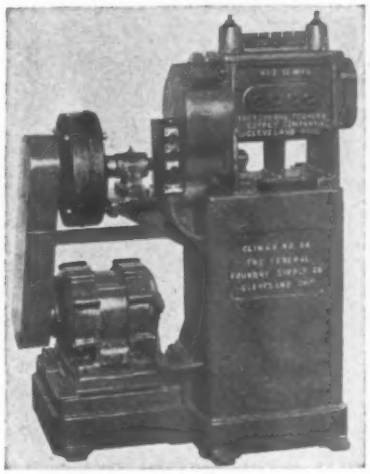

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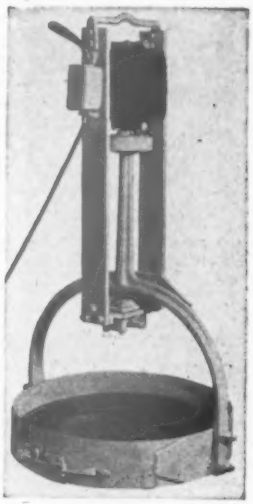

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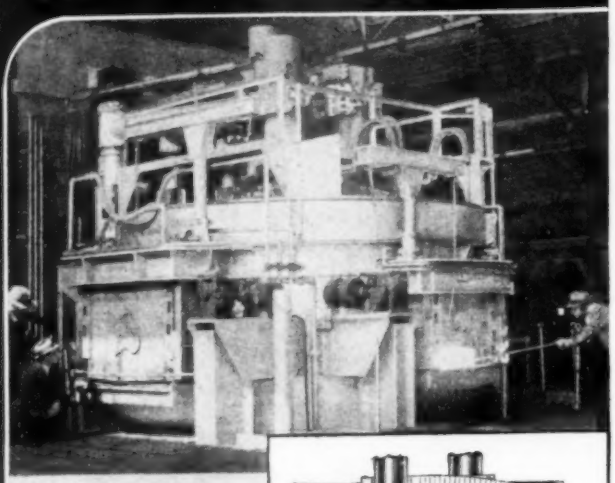

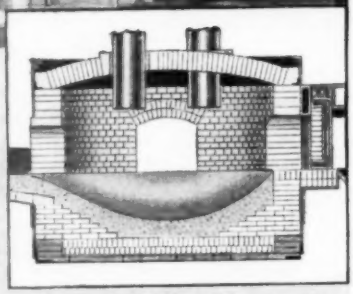

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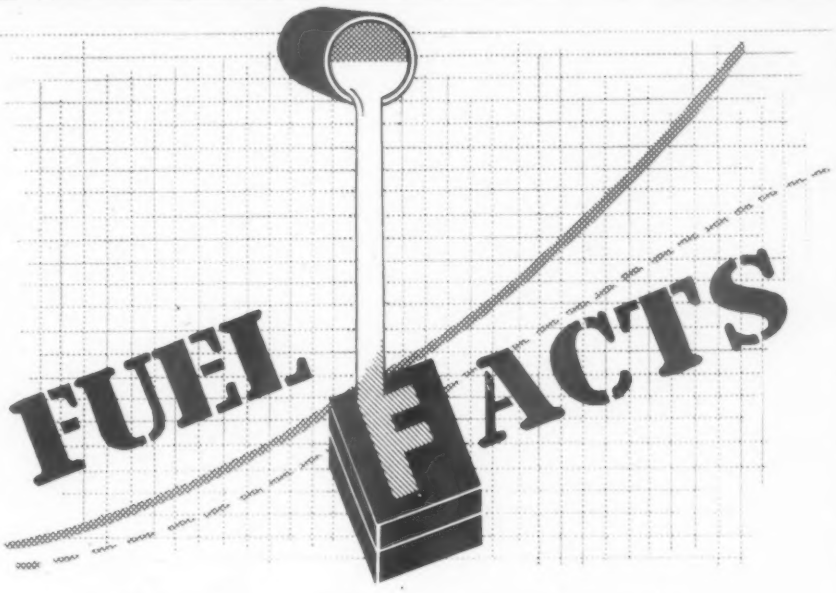

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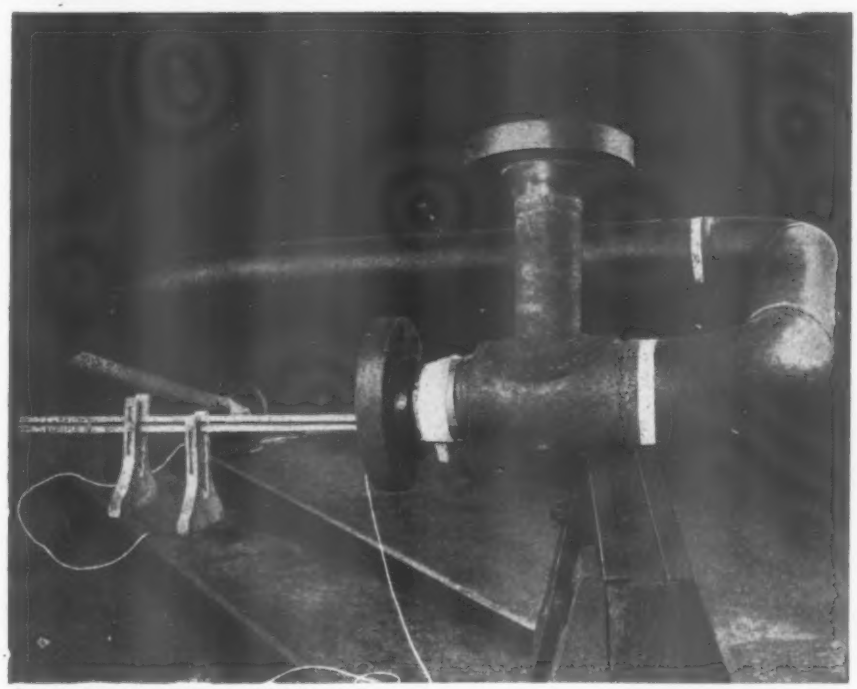

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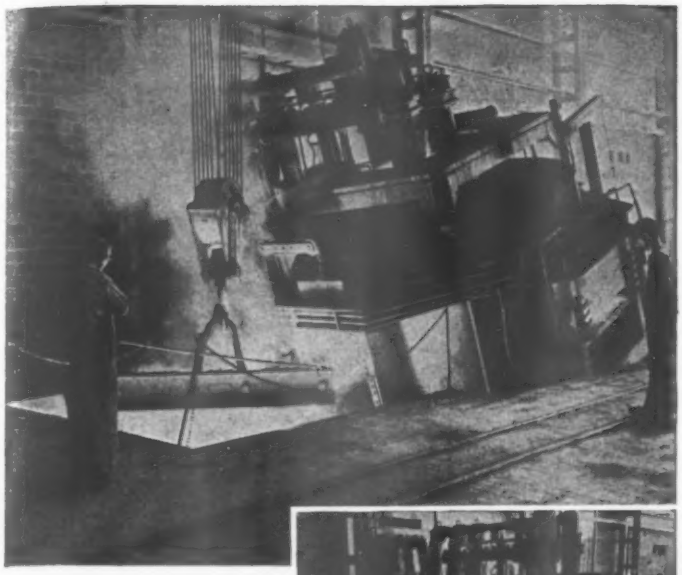

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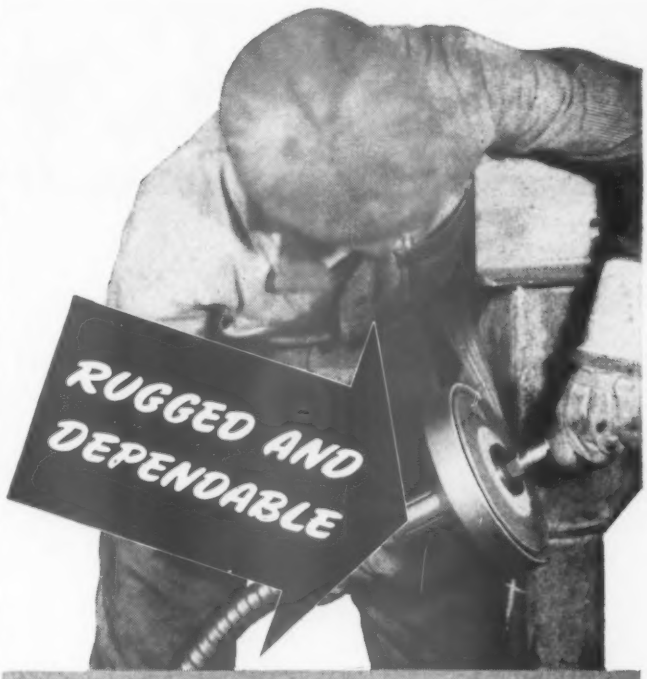

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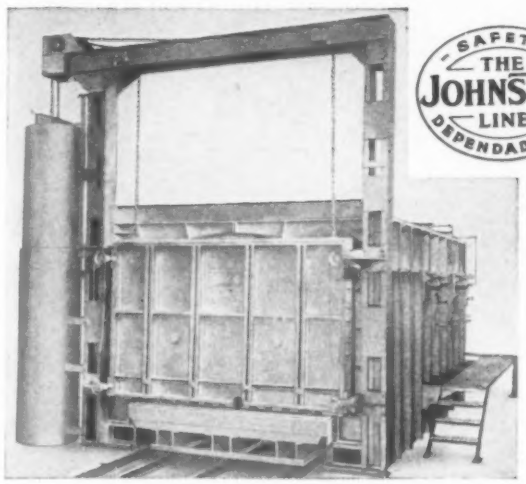

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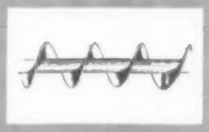

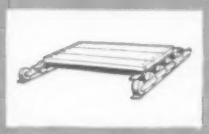

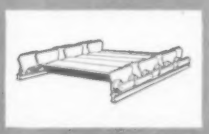

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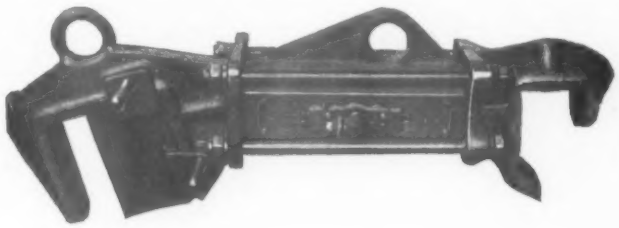

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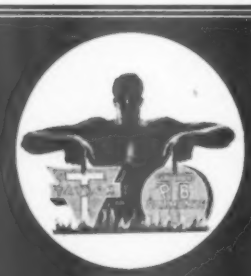

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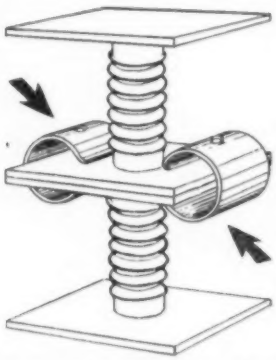

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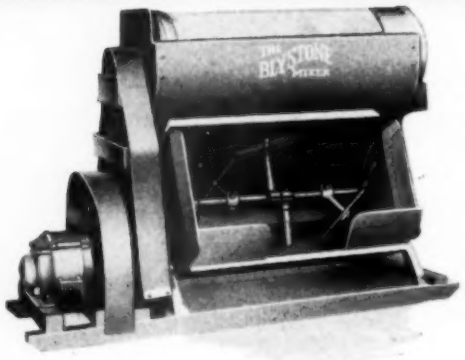

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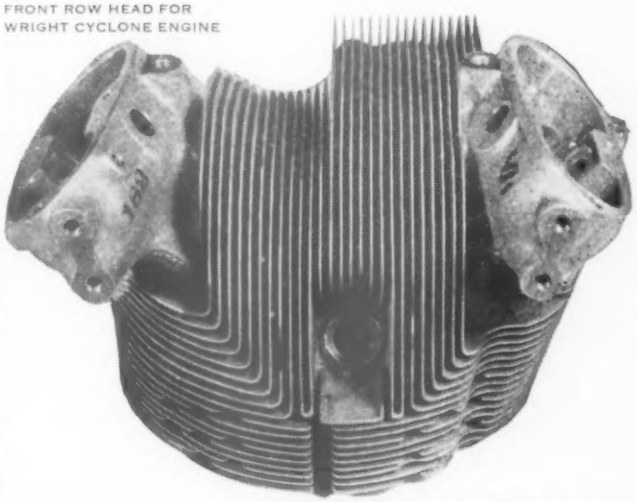

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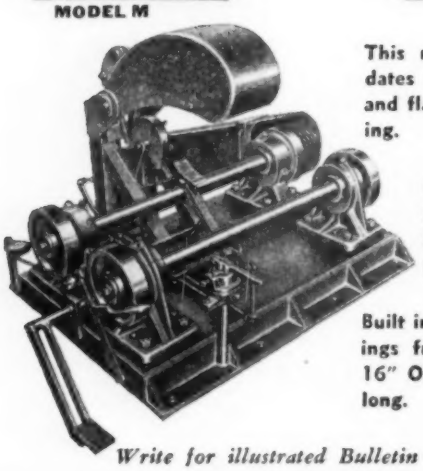

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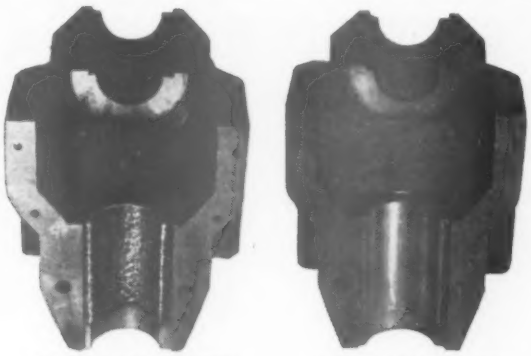

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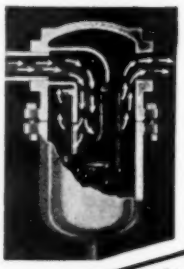

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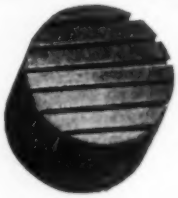

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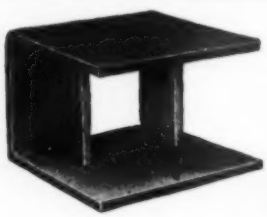

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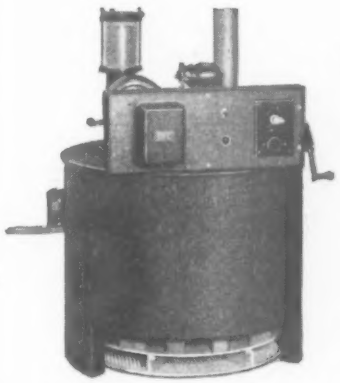

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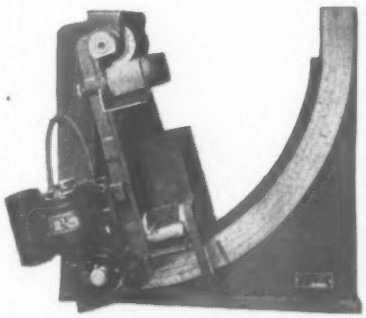

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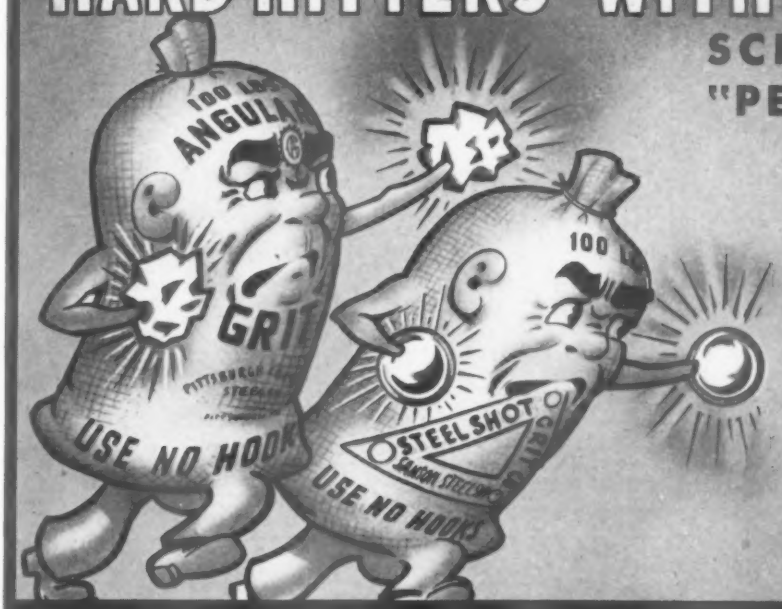

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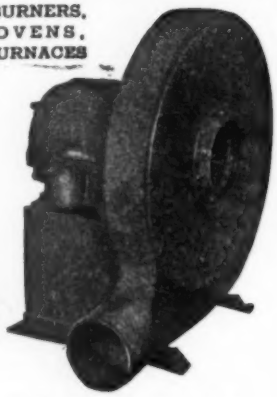

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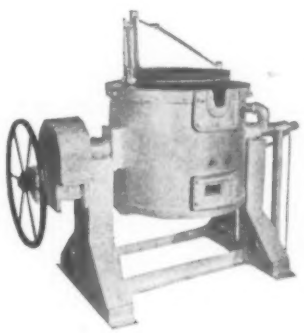

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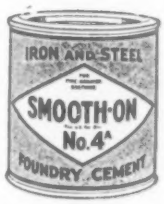

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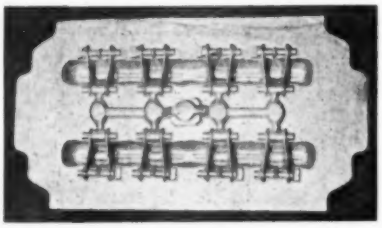

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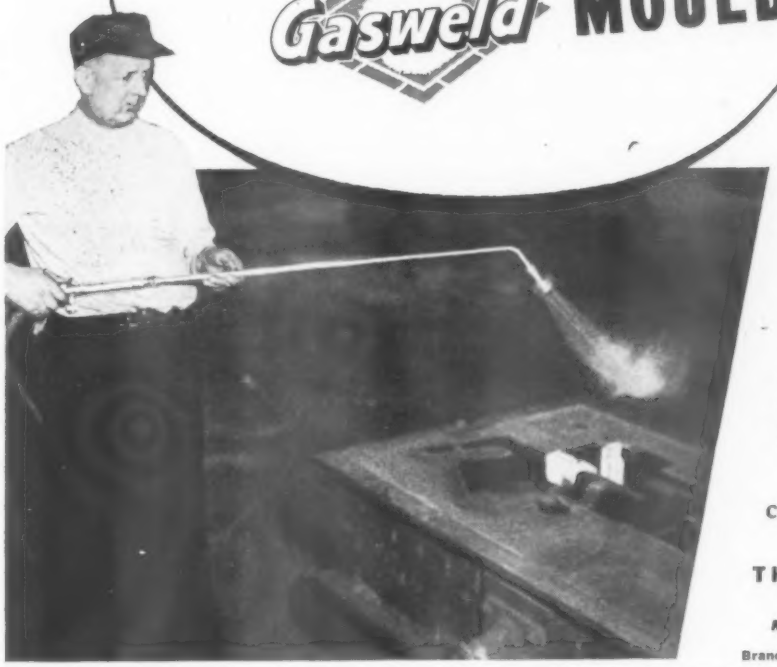

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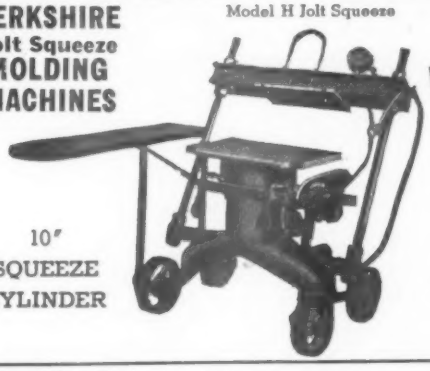

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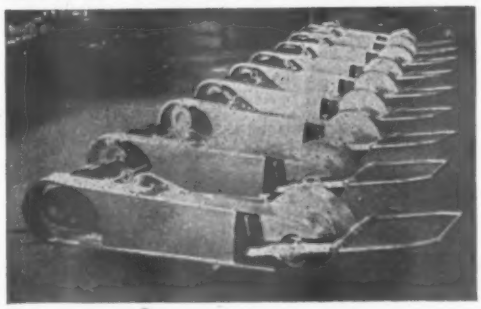

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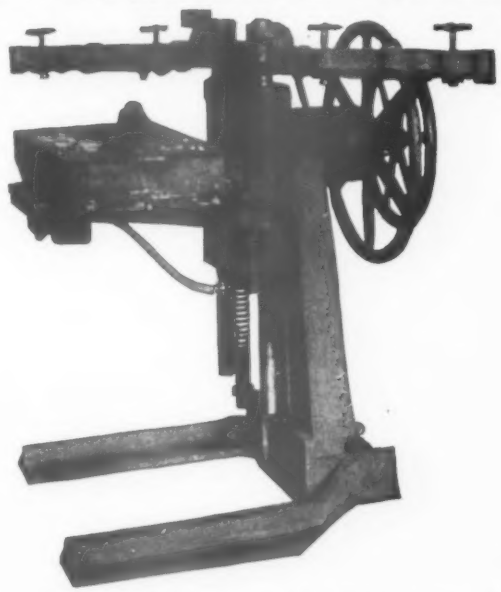

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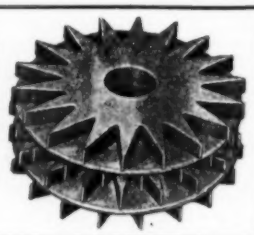

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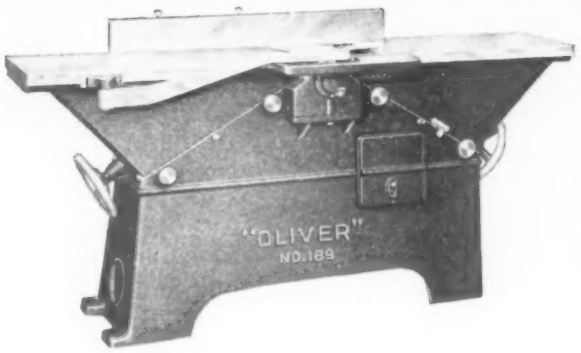

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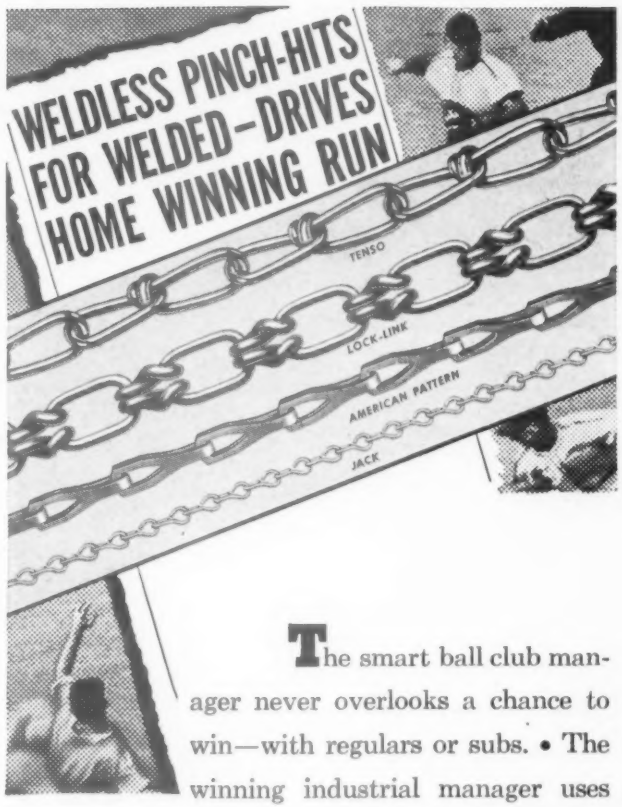

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Wants foreman with considerable experience in actual molding. Prefer man well versed on modern sand practice. Address: Box 386, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY ENGINEER

Permanent mold and die designing experience. Address: Box 402, The FOUNDRY, Cleveland 13, Ohio.

PATTERN MAKER

Wood, iron and aluminum patterns in Gray Iron Foundry near Philadelphia. Capable of taking complete charge. Experience necessary. Permanent position. Good salary. Address: Box 327, The FOUNDRY, Cleveland 13, Ohio.

FOREMAN

Require experienced foreman in gray iron and semi-steel jobbing foundry in southern Michigan. Must be thoroughly familiar with molding, core room, cupola, and good rigger for production. Ability to handle men and produce good castings will mean increased earnings. Reply giving age, experience and reference. Address: Box 417, The FOUNDRY, Cleveland 13, Ohio.

GENERAL CORE ROOM FOREMAN

Experienced in light and medium cores—Malleable Iron Foundry. Excellent opportunity for right man. Give experience, age, salary expected. Located in New York State. Address: Box 419, The FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

MAGNESIUM FOUNDRY ASSISTANT SUPERINTENDENT OR GENERAL SUPERVISOR

Seven years' magnesium experience in producing high quality and quantity aircraft castings. Can organize and control. Knows latest methods and mass production equipment. Thirty-three years' practical foundry experience. Thorough in molding and coremaking, good producer, cost and scrap conscious. Desires connection with post-war possibility. Available, age 51. Willing to locate anywhere in the United States or Canada. Address: Box 381, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT OR GENERAL FOREMAN

Twenty-five years foundry practice, molding, core room cupola and rigger for large or small foundries. Ability to handle men. Address: Box 323, The FOUNDRY, Cleveland 13, Ohio.

PLANT MANAGER OR SUPERINTENDENT

Married, thirty-nine years of age, wife and two children, desires position with post war possibilities. Has background of twenty years' experience in gray iron. Well versed in all phases of the business both green and dry sand work. Can furnish excellent references. Prefer locating in New York, Ohio or Indiana. Address: Box 304, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

Positions Wanted

FOUNDRY MANAGER & METALLURGICAL ENGINEER GRADUATE—FIRST CLASS

Twenty-five years' experience in all phases of foundry operations in Steel, Gray Iron and Nonferrous Metals, desires change with firmly established concern where his executive ability can be fully used and remunerated. Age 47. Address: Box 379, The FOUNDRY, Cleveland 13, Ohio.

GENERAL MANAGER AVAILABLE

A reasonable salary and definite arrangements secures the services of a mature, dependable General Manager who will save his pay several times over in eliminating wastes and skillfully handling personnel, sales, purchases, finance and other vital activities. Excellent experience foundry, machinery and allied lines. Correspondence in confidence. Address: Box 380, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY MANAGER OR SUPERINTENDENT

Thoroughly experienced in all phases of foundry operation. Light to heavy work. Green and dry sand. Practical on molding and coremaking. Thoroughly experienced in cupola control. Well versed in grey iron metallurgy and foundry costs. Thoroughly experienced in production and executive capacities. Sales, contact and expediting experience. Neat appearing and pleasing personality. Draft exempt. Address: Box 311, The FOUNDRY, Cleveland 13, Ohio.

STEEL FOUNDRY METALLURGIST—MELTING SUPERINTENDENT

Twenty years' experience—electric furnace practical operation and all phases technical control. All grades including stainless. Graduate chemist. Address: Box 414, The FOUNDRY, Cleveland 13, Ohio.

NONFERROUS FOUNDRY FOREMAN

Broad practical experience including steam valves, high pressure castings, chilled castings and general jobbing and production work. Prefer position with manufacturing plant. Address: Box 160, The FOUNDRY, Cleveland 13, Ohio.

MAGNESIUM FOUNDRY SUPERINTENDENT

DESIRES POSITION WITH INCREASED OPPORTUNITIES IN AN ORGANIZATION WITH GOOD POST WAR FUTURE. NOW EMPLOYED, SUCCESSFUL BACKGROUND OF PROVEN ABILITY. WIDE KNOWLEDGE OF LATEST METHODS AND EQUIPMENT. GOOD ORGANIZER. COST CONSCIOUS. YOUNG, AGGRESSIVE. AVAILABLE IMMEDIATELY. LOCATION NOT IMPORTANT. ADDRESS: BOX 405, The FOUNDRY, CLEVELAND 13, OHIO.

MR. HEATER MANUFACTURER

Available in late spring. A thorough and practical foundryman in the early forties with a background of 23 years of practical experience in the design and manufacture of hot air furnaces, boilers, etc. with several of the leading companies of the industry. Well versed in equipment design for topnotch modern production methods for a competitive market. Address: Box 352, The FOUNDRY, Cleveland 13, Ohio.

MAINTENANCE ENGINEER

Electrical and mechanical. Twenty years' experience, supervisory capacity and industrious. Builder. Address: Box 393, The FOUNDRY, Cleveland 13, Ohio.

MAGNESIUM FOUNDRYMAN

Foundryman with practical knowledge of magnesium melting, molding and core practices desires position with reliable concern as Foundry Superintendent, Assistant Superintendent or Contact Man. Experienced in gating and rigging of patterns for production work. Twenty years of foundry experience. Best of references. Available for interview at any time. Address: Box 412, The FOUNDRY, Cleveland 13, Ohio.

CORE FOREMAN

Wants position. Age 44. Has had 27 years' experience as core maker and foreman. Expert in production work. Available about March 15th. Address: Box 407, The FOUNDRY, Cleveland 13, Ohio.

NONFERROUS FOUNDRY SUPERINTENDENT

Will be open for position by April 1, 1944. Have had 30 years in executive capacity, knowing all phases from melting zone to shipping dock. Best of references will be furnished as to ability and success. Address: Box 410, The FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

FOREMAN OR SUPERINTENDENT

Desire a job in gray iron or brass foundry as foreman or superintendent. Twenty-five years' experience in foundry work. Fifteen years as foreman and superintendent. Best of references. Address: Box 406, The FOUNDRY, Cleveland 13, Ohio.

STEEL FOUNDRY WORKS OR GENERAL MANAGER

TECHNICAL MAN WITH SHOP AND ADMINISTRATIVE EXPERIENCE IS AVAILABLE ON SHORT NOTICE. ADDRESS: BOX 373, The FOUNDRY, CLEVELAND 13, OHIO.

PERMANENT MOLD ENGINEER

DESIGNER WITH COMPLETE KNOWLEDGE OF MAGNESIUM AND ALUMINUM FOUNDRY METALLURGY SEEKS CONNECTION WITH NEW OR EXISTING FOUNDRY. ADDRESS: BOX 375, The FOUNDRY, CLEVELAND 13, OHIO.

GRAY IRON FOUNDRY SUPERINTENDENT OR FOREMAN

Thirty-two years' experience in jobbing and production foundries. Ten years as foreman and assistant. Superintendent practical foundryman in every detail. Best references, temporary jobs not considered. Age 49 years. Address: Box 415, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Wide experience, now available. Practical molder and core maker. Twenty years as superintendent. Medium and heavy, high grade machinery and jobbing castings, green and dry sand. Well versed in metallurgy. Address: Box 284, The FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT AND FOUNDRY ENGINEER

Who have an excellent past record in producing magnesium aircraft castings are desirous of making change. If interested can furnish best of references as to character and ability. Address: Box 399, The FOUNDRY, Cleveland 13, Ohio.

WORKS OFFICE, PERSONNEL, EMPLOYMENT, SAFETY

FOR TWENTY YEARS A SUPERVISOR IN WORKS OFFICE, PERSONNEL, EMPLOYMENT, SAFETY AND PRODUCTION IN LARGE STEEL FOUNDRY AND MACHINE SHOPS. FAMILIAR WITH MANAGEMENT PROBLEMS IN PLANT ORGANIZATION. RESUME WITH REFERENCES AVAILABLE FOR COMPANY EXECUTIVES ONLY. ADDRESS: BOX 401, The FOUNDRY, CLEVELAND 13, OHIO.

FOUNDRY FOREMAN OR ASSISTANT

Twenty-three years of foundry practice qualifies me for a position with medium size foundry as foreman or assistant. Fair salary to start. Prefer West Coast. Have had foremanship. 52 years of age. Address: Box 397, The FOUNDRY, Cleveland 13, Ohio.

PLANT SUPERINTENDENT

Well versed in the production of iron, malleable iron, bronze and aluminum castings desires a connection in the South or Southwest. Successful record with some of the larger producers. Responsibly employed at present but desires better health conditions for one of the members of family. For complete details address: Box 234, The FOUNDRY, Cleveland 13, Ohio.

METALLURGICAL ENGINEER

Twenty years' experience in all phases of jobbing foundry operations in steel, cast iron and nonferrous metals. Desires position with established concern with post war possibilities. Would consider foreign service. Age 50. Address: Box 362, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPPLY & EQUIPMENT SALES REPRESENTATIVE

Twenty years' experience, AFA member, wishes to represent manufacturers of foundry supplies and equipment or allied items on the West Coast. Can furnish excellent references. Address: Box 392, The FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

STEEL FOUNDRY GENERAL MANAGER AND SALES MANAGER

Will take complete charge of steel foundry production and sales. Twenty years' experience in jobbing and production foundries. Thoroughly familiar in costs and selling prices. Desires to make change from present position where he has raised selling price one-hundred dollars a ton in six months by changing class of work; increased production twenty-five per cent with fewer employees. Age 42. Have connections for good post war work. Address: Box 384, The FOUNDRY, Cleveland 13, Ohio.

SALES ENGINEER—EXECUTIVE

Desires position with foundry manufacturing malleable and grey iron castings to take complete charge of sales. Twenty-five years' experience in the manufacture and sale of castings, metallurgist, practical and technical foundry training. Middle age, married and can furnish best of references. Employed at present and available on thirty days' notice. Address: Box 416, The FOUNDRY, Cleveland 13, Ohio.

GRAY IRON SUPERINTENDENT OR FOREMAN

Middle age, married, good habits and personality wishes contact with medium size job foundry. Qualified and dependable. Address: Box 418, The FOUNDRY, Cleveland 13, Ohio.

Employment Service

SALARIED POSITIONS

This advertising service of 34 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details.

R. W. BIXBY INC.
101 Delward Bldg. Buffalo, N. Y.

GRAY IRON FOUNDRY EMPLOYMENT

We are receiving many inquiries for superintendents, metallurgists and foremen. We shall be glad to hear from qualified men. No charge.

Gray Iron Founders' Society Inc.
1010 Public Square Building Cleveland, Ohio

Wanted-To-Buy

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price for immediate acceptance. Address Box 578, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Used 1000 pound per hour electric melting furnace with or without transformer. Address: Box 371, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Sand Cutter for Molding Floors—Must be in First Class Condition. Send full particulars to D. J. Murray Manufacturing Co., Wausau, Wisconsin.

Opportunities

FOR SALE

Small established 35 year old manufacturing business consisting of small foundry and machine shop producing several finished cast iron specialty lines. Sales mostly by mail to reliable processing and industrial firms in almost every state of Union. Plenty business on hand and postwar outlook bright. Price $9000 which includes buildings, land, machinery, patterns, customer records and goodwill. Equipment alone worth more than this figure. Owner retiring. Excellent opportunity for foundryman or patternmaker who wishes to get into a profitable business for himself. Address: Box 408, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

Opportunities

SALES REPRESENTATIVE

Would like a source for Grey Iron and Steel Castings reasonable distance from Detroit. Address: Box 409, The FOUNDRY, Cleveland 13, Ohio.

Foundry Work Wanted

Open Capacity for Ferrous and Non-Ferrous Castings
Wagner Molds and Methods

WAGNER PERMANENT MOLD COMPANY
Burbank, California

For Sale

FOR SALE

Late model Clearfield Mixer, Muller type 11 to 14 cu. ft. capacity. 6 ft. pan.

Vibrating screen—Tyler Hummer Electric 4 ft. x 7 ft.

5 H.P. Witte Diesel Engine.

54—500 watt RLM Electric Light Reflectors.

BECKETT BRONZE CO., MUNCIE, INDIANA

FOR SALE
NEW BLYSTONE MIXERS

Two Blystone Core Sand Mixers, model B-2½ 11 cubic feet capacity, with manganese steel lining. Clutch pulley drive.

THESE MIXERS ARE NEW AND AVAILABLE FOR IMMEDIATE DELIVERY

DENNY & CLARK
910 N. Marshfield Ave. Chicago 22, Ill.

FOR SALE

2—20" Walker-York Coke Fired Furnaces with crucibles. Furnaces never used, still in original crates.

JOHN WOOD MFG. CO., INC.
CONSHOHOCKEN PENNSYLVANIA

REBUILT USED EQUIPMENT

Molding machines, all types; tumbling mills; furnaces; cupolas; air compressors; hoists; rammers, all types; ladles, all types; sand mixers; sand blast tanks; core machines, etc. All equipment rebuilt and guaranteed. All sizes used steel flasks.

HAYNES FOUNDRY EQUIPMENT COMPANY
1734 Lake St. Kalamazoo, Mich.

AIR COMPRESSORS

BELTED—176 ft., 355 ft., 540 ft., 676 ft., 752 ft. & 1300 ft.

ELECTRIC—355 ft., 528 ft., 676 ft., 807 ft., 1302 ft., 1723 ft., 2022 ft., 2200 ft., 2800 ft., 3600 ft., & 5000 ft.

STEEL TANKS

9—5000 gal., 11,500 and 18,000 gal. cap.
17—1000 bbl., 4000 bbl. and 10,000 bbl. cap.

TANKS BOUGHT AND SOLD

R. C. STANHOPE, INC.
60 East 42nd St. New York, N. Y.

For Sale

COMPRESSORS AND BLOWERS

2100 cfm @ 12 oz. Gen. Elec. Centrifugal compressor with 10 HP 2-60-3450 RPM motor.
2—1200 cfm @ 11 oz. Buffalo Pressure Blowers, 9½" intake 7" x 7¼" outlet, with 7½ HP 3-60-1800 RPM motors.

SAND VIBRATOR

7 to 8 ton per hours, Jeffery-Traylor with vibrator M.G. set. Write, wire or phone.

THE MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVE., CLEVELAND 14, OHIO

REBUILT

BLOWERS—FANS—EXHAUSTERS

Roots-Connersville positive cupola blowers. Centrifugal blowers for gas and oil burning. Sand blast, grinder end dust exhausters. Ventilating fans.

GENERAL BLOWER COMPANY
406 N. Peoria St. Chicago, Ill.

BLAST FURNACE FOR SALE

Traylor Engineering 36" by 108"; 2 blowers No. 9 Monogram Sturtevant; 2 blowers Roots-Connersville; 54" and 60" blow pipe ¼" metal; 1 krupp Mill-Whip hammer screen; pulverizers-crushers-Raymond Mill; 10 ton chain hoist; pyrometers, etc. All the above used but one year. Address: H. A. Woodworth, 705 Olive St., St. Louis, Mo.

FOR SALE
PANGBORN SAND BLAST

Type 2 GH-5 cu. foot barrel capacity. Direct pressure blast application. Complete unit with blast machine and abrasive separator. Arranged for motor drive. This unit is in perfect condition. Price cheap.

GLOBE TRADING COMPANY
920 W. LAFAYETTE BLVD.
DETROIT, MICH. CAD. 0198

WHEELABRATOR & BLOWER

2—American Foundry & Machine Co. "Tum Blast Wheelabrators". Both are Model 20" x 27".

1—Root Connersville No. 3 12" x 42" Blower Rating—2365 C.F.M. at 1 lb. Pressure. Can be motorized easily.

All in good working order.

UTICA DROP FORGE & TOOL CORP.
UTICA 4, NEW YORK

FOR SALE
FOUNDRY EQUIPMENT

48" American sandcutter, 220 volt, 60 cycle, 3 phase. $475. Address: Dornback Furnace & Foundry Co., 724 E. 103rd St., Cleveland 8, Ohio.

FOR SALE

1—Used Single phase Electric Steel Furnace complete with transformers, 12,000 volt primary. Automatic Electrode Control, etc. Purchased new May 1942. Has been producing 7 tons daily. Can make shipment within 3 days. Price F.O.B. shipping point $5500. Address: Box 161, The FOUNDRY, Cleveland.

OVEN FOR SALE

Single Compartment Young Brothers Oven 13'3" x 27' x 6'3" high, inside. Gas fired 200° to 500° F. complete with automatic controls. Suitable for core drying. Address: Marsh Wall Products, Inc., Dover, Ohio.

FOR SALE

Fully equipped wood and metal pattern shop in Chicago district, making all kinds of wood and metal patterns. Would consider selling interest in same. Address: Box 389, The FOUNDRY, Cleveland 13, Ohio.

For Sale

REBUILT EQUIPMENT IN STOCK
IMMEDIATE SHIPMENT

(1)—3-ton geared crane type Ladle.
(2)—¾" cap. Power Sprue Cutters.
(1)—10" Tabor Post Type Squeezer.

ELECTRIC MONORAIL HOISTS

(2)—3-ton Euclid 110/230-VDC.
(1)—1-ton Shepard, 230-VDC.
(2)—1-ton Shepard stationary mounted Hoists, separate variable speed controllers.
(1)—1-ton 2-motor Cleveland Tramrail, 220-VDC. FL. or Cage Operated.
(1)—6-ton LoHed Hoist, 220/3/60-cycle.

BUCKETS

(1)—¾-yd. 2-line Browning type Z-½.
(1)—¾-yd. Hayward Electric 220-VAC.
(2)—1½-yd. Hayward Electric 230-VDC.

OVERHEAD ELECTRIC TRAVELING CRANES

	TONS	MAKE	SPAN	CURRENT
(1)	3	Shaw	30'0"	230-VDC.
(2)	3	Euclid up to	40'0"	A.C. or D.C.
(1)	5	Euclid	30'11"	220-VAC.
(1)	10	P & H	58'3"	230-VDC.
(1)	10	American	54'1½"	230-VDC.
(1)	3	(new) Armington 3-motor 230-VDC. underslung FL. or CG. OP. Will furnish rebuilt to your span.		

WE OWN AND HAVE ALL THIS EQUIPMENT IN STOCK. IT IS OFFERED REBUILT IN OUR LARGE MODERN PLANT AND FULLY GUARANTEED.

T. B. MacCABE CO. 4304 CLARISSA ST.
PHILADELPHIA (40) PENNA.

SPECIAL DEFENSE BARGAINS

Cast Iron and Steel Plate Mill-Dust & Shavings Exhausters 50 in stock. **Cupola and Furnace** Blowers for Coke, Oil or Gas Combustion.
1—Spencer blower 3600 CFM @ 1½ lbs.—40 h.p. motor, and blast gate.
1—Spencer Blower 2250 C.F.M.—1½ lbs.—25 H.P.
2—Sprague 4 Ton Electric Hoists 115 V.—D.C.
1—Sprague 2 Ton Electric Hoist 115 V.—D.C.
Tumbling Mills—2 cast iron for brass cleaning.
1—Sly 48" x 60"—1" thick round steel shell.
2—36" dia. x 60" round 1" shell.
Furnaces:
1—US Rotary No. 3—Melting or Smelting.
1—Pair Monarch-Rockwell's—Rotating, each 500 lbs. cap. mounted together on base, oil burners available, when used together waste heat from one preheats other.
1—Hausfeld, Tilting Open Flame 400 lb. capacity—non crucible.
1—Stationary for up to No. 70 crucible.
1—Al. Fdy. Eq. Co. Model-550 TW. Tilting Crucible for No. 275 Crucible, Core Ovens, Portable, Eastern location.
1—Buckeye Semi Circular 5 revolving shelves, gas or coke fuel.
1—Core oven, portable 4-6" high 4 shelves gas fired, insulated.
1—Core Sand Mixer, Triumph make (dough mixer type) approx. 4 cu. ft. cap. 3—H.P. motor geared direct, 3/60/220 A.C.
Molding Machines:
1—Battenfeld stationary 17" x 22" platen—jolt-squeeze.
1—Type F International 26" x 36" platen, air jolt-roll over, eight inch draw stationary.
1—Tabor plain jolt table No. B-18—54" x 96".
1—Arcade—portable squeeze 18" x 20" platen.
Compressors:
1—Chicago 7½" x 6" 106' capacity, 100 lbs.
1—Chicago 12" x 8" 240' cap., 70 lbs.
1—Worthington Feather Valve 150' cap., 100 lbs.
1—Chicago—8" x 8"—Horizontal, 128'.
1—Chicago—6" x 6"—50' cap.
1—Worthington 2 stage 450' cap.
Curtis & Gardner 4½" x 4½" Vertical 19', many smaller.
Tested-air receivers—12" up to 36" dia.

CLIFTON MACHINERY CO.
1023 W. 6TH, CINCINNATI 3, OHIO

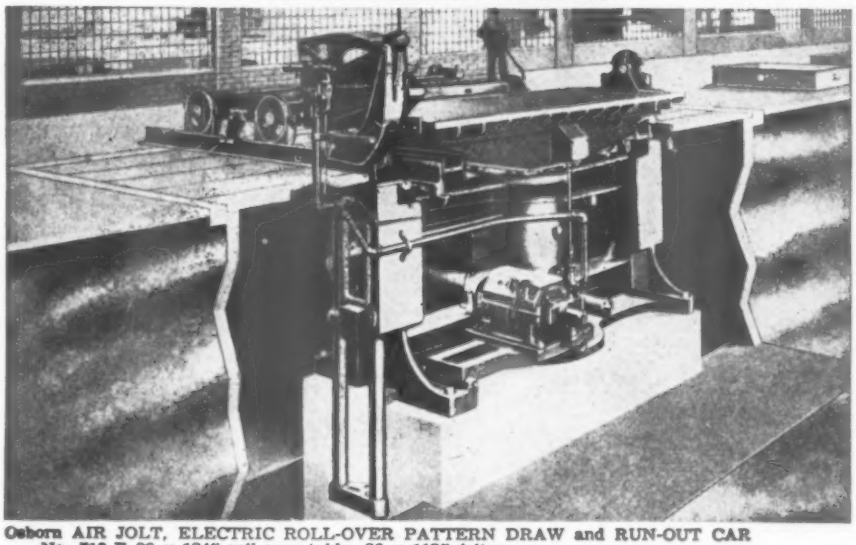
FOUNDRY—NONFERROUS

Sales $500,000 year. Near Cleveland, modern equipped, large backlog. Health compels sale. Have others—ferrous or nonferrous, both large or small. Address: Apple Company Brokers, Cleveland, Ohio.

SCULLY Reconditioned Foundry Equipment

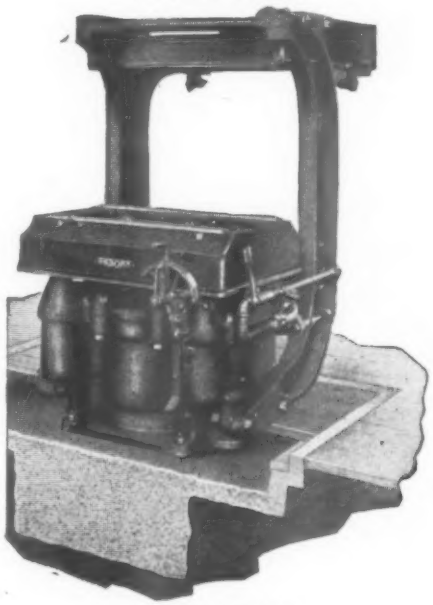
★ ALL SCULLY EQUIPMENT IS REBUILT AND OVERHAULED IN OUR OWN, NEW MACHINE SHOP

OSBORN MOLDING MACHINE



Osborn AIR JOLT, ELECTRIC ROLL-OVER PATTERN DRAW and RUN-OUT CAR
No. 513-E 36 x 124" roll-over table, 36 x 112" jolter.

OSBORN JOLT SQUEEZE & POWER STRIP



No. 703 OSBORN
(Similar to above excepting with roll-off)

No. 703-6 Osborn jolt squeeze and strip, 21 x 28" table, stationary. Length of opening in lifting frame 34", 6" pattern draw, 8" cyl. dia. 1000 lbs. jolting cap. @ 80 lbs. press. Distance from lifting frame to squeeze head 24¼", flask length 44¼" with roll-off conveyor.

No. 703-5 Osborn, same as above, excepting 17 x 35" table.

PANGBORN "GJ" ROTOBLAST complete with Loader and Motors—max. cap. 16 cu. ft.—drum inside 40 x 48".

MISC. MOLDING MACHINES

No. 112 Arcade portable jolt roll-over and squeeze, pattern draw, table accommodates pattern plates up to 13 x 33"—9" draw, distance between uprights 36".

No. 330 Arcade portable jolt roll-over and squeeze, table accommodates pattern plates up to 17 x 34"—10" draw, distance between uprights 44".

28-30" Tabor, 28 x 40" roll-over plate, 12" draw, 1000 lbs. cap. @ 80 lbs.

No. 815 Johnston & Jennings, 30 x 40" roll-over table, 1200 lbs. cap. @ 80 lbs. pressure, 15" pattern draw.

No. 602 Osborn jolt roll-over draw, portable, 24 x 30" flask cap., 900 lbs. cap. @ 80 lbs. press., 10" draw.

No. 22 Davenport, jolt roll-over draw, 20 x 30" table, 750 lbs. cap. @ 80 lbs. press., 10" draw.

PLAIN AIR SQUEEZERS

Tabor portable, 32" between rods, 10" cyl., 16 x 17" table.
International Type "H"—36" between rods, 14 x 21" table, 10" dia. cyl. (1-38" between rods, 16 x 24" table, 13" cyl.)

JOLT SQUEEZERS

No. 76 Arcade straddle portable type with swing-head, 17 x 20" table, 10" dia. cyl.

PLAIN JARRING MACHINES

36 x 48" Tabor, 10" dia. cyl., 4500 lbs. cap. @ 80 lbs. press.
42 x 60" Tabor, 13" dia. cyl., 7500 lbs. cap. @ 80 lbs. press.
60 x 60" Tabor, 14" dia. cyl., 8500 lbs. cap. @ 80 lbs. press.

Pangborn 6 ft. dia. TYPE EH-1 CABINET TABLE INSTALLATION, 5 ft. high partition, Abrasive Handling and Reclamation System, Belt and Bucket Type Elevator, Sandblast Pressure Tank.

AMERICAN SANDCUTTERS

Cleveland-American (similar to Model "K") 84" spiral cutting cyl., 36" dia., 92" between tractor wheels, 5" face—equipped with Cleveland 3-phase 60 cycle 220V AC Motors, Cable and Take-Up Reel.

Cleveland-American 4-motor Model F-Type 113-92, 80" cutting cyl., 8½ ft. between tractor wheels, 220V AC Motors, Cable and Reel.

American Fdry. Model "K" heavy duty type, size 72, equipped with Buda Type "WTU" 20 HP Gas Engine. 72" between tractor wheels, 6" face, having 60" cutting cyl.

CORE TURN-OVER MACHINES

Pridmore Type "H" 16 x 14"—8" drop, portable rock-over drop.

Pridmore Type "H" 22 x 18"—8" drop, portable, rock-over drop.

MISC Hand Roll-Over Molding Machines, International Type "R" 24 x 10" draw, portable, spec. core turn-over, Tabor, portable, hand roll-over, hand draw, 1, 16-18" 8" draw and 1—20-22"—8" draw.

JOLT SQUEEZE STRIPPERS

No. 113 Milwaukee, open end type, portable, 500-lbs. cap. @ 80 lbs., 6" draw, 16 x 35" table.

Osborn No. 82 STRIPPING PLATE JOLT SQUEEZER, 46" between rods, 10" draw, 1200 lbs. jolting cap., 1000 lbs. stripping cap. 24 x 36" table, pin lifts 12" part one way, 36" the other.

Nicholls Type "D" stationary heavy duty JOLT SQUEEZE & PATTERN DRAW, squeeze piston 14" jolt piston 6", draw 2-6"—distance between strain rods 40" take approx. 15 x 24" flask.

MAGNETIC SCREEN SEPARATOR

Magnetic Mfg. Co. size 30" dia. x 80" long drum SCREEN MAGNETIC SEPARATOR 115 V 4.5 Amps. Type F-3, complete with shunt wound 3 HP DC 1700 RPM Motor, elevator 10'4" O/A height, 18" width, 22" depth.

Coombs Type "V" Gyratory Riddles, 21" dia., equipped with 1/6 HP GE 220V DC 900 RPM Motor.

SCULLY MACHINERY & EQUIPMENT CORP.

(Formerly - Foundry Division of Scully-Jones & Co.)

2031 WEST 74th STREET (Phone PROspect 8770) CHICAGO 36, ILLINOIS

ADVERTISING INDEX

Acme Foundry Co. 207
Adams Co., The 58, 92
Air Reduction 33
Ajax Electric Co., Inc. 180, 181
Ajax Electric Furnace Corp. 180, 181
Ajax Electrothermic Corp. 180, 181
Ajax Engineering Corp. 180, 181
Ajax Metal Co. 180, 181
Alloy Metal Abrasive Co. 219
Aluminum Refiners Div. of Bohn Aluminum & Brass Corp. 93
Aluminum Research Institute 69
American Air Filter Co., Inc. 26
American Bridge Co. 203
American-British Chemical Supplies, Inc. 205
American Chain & Cable Co., Inc. 233
American Crucible Co. 195
American Foundry Equipment Co. 130, 131, 175
American Gum Products Co. 232
American Monorail Co., The 137
American Optical Co. 49
American Smelting & Refining Co., Federated Metals Division 74
Ansul Chemical Co. 197

Bartlett, C. O., & Snow Co. 23
Beardsley & Piper Co., The 36, 37
Bellevue Industrial Furnace Co. 212
Berkshire Mfg. Co. 229
Bethlehem Steel Co. 1
Blaw-Knox Div. of Blaw-Knox Co. 95
Blystone Div. Standard Sand & Machine Co. 214
Bohn Aluminum & Brass Corp. 14, 93
Bondite Corp. 45
Brooke, E. & G., Iron Co., The 233
Buckeye Products Co., The 192
Buehler, Ltd. 24
Buell Engineering Co., Inc. 121
Buffalo Wire Works Co., Inc. 226

Campbell-Hausfeld Co., The 171
Canadian Radium & Uranium Corp. 225
Cannon Vibrator Co. 229
Carborundum Co., The 80
Carl-Mayer Corp., The 18
Carman, Edwin S., Inc. 218
Casein Company of America (Division of The Borden Company) 215
Centrifugal Casting Machine Co. 216
Certified Core Oil & Mfg. Co. 151
Chain Belt Co. 50
Champion Foundry & Machine Co. 8, 9
Chicago Eye Shield Co. 222
Chicago Manufacturing & Distributing Co. 138
Chicago Rawhide Mfg. Co. 217
Chicago Tramrail Co. 172
Chicago Wheel & Mfg. Co. 173
Cities Service Oil Co. 208
Clark Tructractor Div. of Clark Equipment Co. 206
Clearfield Machine Co. 27
Cleveland Chaplet & Mfg. Co. 212
Cleveland Electro Metals Co., The 194
Cleveland Flux Co., The 53
Cleveland Tramrail Division, The Cleveland Crane & Engineering Co. 77
Clipper Mfg. Co. 200
Columbia Steel Co. 203
Combined Supply & Equipment Co., Inc. 220
Conco Engineering Works 193
Construction Machinery Co. 232
Corn Products Sales Co. 153
Cortland Grinding Wheels Corp. 169
Cunningham, M. E., Co. 222

Davenport Machine & Foundry Co. ..... Front Cover
Dayton Oil Co., The 125
DeBardeleben Coal Corp. 219
Delta Oil Products Co. 35
Demmler, Wm., & Bros. 170, 230
Desmond-Stephan Mfg. Co. 232
Despatch Oven Co. 32
Detroit Electric Furnace Division Kuhlman Electric Co. 174
DeWalt Products Corp. 73
Diamond Clamp & Flask Co. 76
Dietert, Harry W., Co. 221
Dougherty Lumber Co. 222

Eastern Clay Products, Inc. 128
Eastman Kodak Co. 135
Electric Furnace Co. 141
Electro Metallurgical Co. 55
Electro Refractories and Alloys Corp. 91

Fanner Manufacturing Co., The 88
Federal Foundry Supply Co., The 2, 145, 199
Fisher Furnace Co. 201
Foundry Equipment Co., The 70, 71
Foundry Rubber Compounds Corp. 16
Foundry Services, Inc. 196
Fox Grinders, Inc. 229
Freeman Supply Co., The 96
Fremont Flask Co., The 22
French & Hecht, Inc. 215
Fuller Co. 179

Gehnrich Oven Division, W. S. Rockwell Co. 89
General Blower Co. 224
General Electric X-Ray Corp. 56, 57
Giele, Walter, Co. 229
Globe Iron Co. 225
Globe Steel Abrasive Co. 231
Great Western Mfg. Co. 231
Greene Electric Furnace Co. 232
Greenfield, Samuel, Co., Inc. 17
Grimes Molding Machine Co. 231

Hammond Machinery Builders, Inc. 221
Hanna Furnace Corp., Div. National Steel Corp. 34
Haskins, R. G., Co. 205
Hauck Manufacturing Co. 220
Haws Refractories Co. 210
Hercules Powder Co., Inc. 127
Herman Pneumatic Machine Co. 83
Hines Flask Co. 30, 31
Houghton, E. F., & Co. 20, 21
Hydro-Blast Corp. 42, 43

Illinois Testing Laboratories, Inc. 190
Imperial Belting Co. 187
Independent Pneumatic Tool Co. 87
Industrial Equipment Co. 215
Industrial Gloves Co. 232
International Molding Machine Co. 63
International Nickel Co., Inc., The 119
International Paper Co. 207
Ironton Fire Brick Co., The 72

Jackson & Church Co. 204
Jackson Iron & Steel Co., The 216
Jeffrey Mfg. Co., The 211
Johns-Manville 182
Johnson Corp., The 218
Johnston Mfg. Co. 211

Kelley-Koett Mfg. Co., The 60
Kirk & Blum Manufacturing Co. 84

Lanly Co., The 189
Lindberg Engineering Co. 40
Link-Belt Co. ..... Back Cover
Liquid Carbonic Corp., The 229
Loftus Engineering Corp. 216

McCormick, J. S., Co. 78
McLain's System, Inc. 230

Macklin Co. 12
Mahler, Paul, Co. 48
Magnaflux Corp. 41
Mahon, R. C., Co., The 65
Mahr Manufacturing Co. 62
Mall Tool Co. 227
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc. 225
Marathon Chemical Company Div. of Marathon Paper Mills Co. 64
Marshall, L. H., Co. 202
Master Electric Co. 25
Master Tool Co. 133
Mathieson Alkali Works (Inc.) Inside Front Cover
Michigan Smelting & Refining Div. of Bohn Aluminum & Brass Corp. 14
Midwest Abrasive Co., The 19
Midwest Foundry Supply Co. 230
Milwaukee Chaplet & Mfg. Co. 185
Milwaukee Foundry Equipment Co. 29
Modern Equipment Co. 240
Molybdenum Corp. of America 155
Monarch Engineering & Mfg. Co. 227
Murphy, James A., & Co. 197

National Carbon Co., Inc. 39
National Engineering Co. 10, 11
National Steel Corp. 34
Neff & Fry Co., The 217
New Haven Vibrator Co. 213
Niagara Falls Smelting & Refining Corp. 213
Norton Co. 67

Ohio Ferro-Alloys Corp. 239
Oliver Machinery Co. 233
Osborn Manufacturing Co., The 46, 47
Ottawa Silica Co. 82

Pangborn Corporation 6, 7, 166, 228
Penn Iron Works 221
Pennsylvania Foundry Supply & Sand Co. 203
Penola, Inc. 61
Phillips, C. E., & Co. 217
Pickands Mather & Co. 85
Pioneer Mfg. Co. 192
Pittsburgh Crushed Steel Co. 223
Pittsburgh Lectromelt Furnace Corp. 188
Plaster Process Castings Co. 228
Pollard Oil Products Co. 230
Producers Core Sand Corp. 232
Progressive Core Wire Co. 232
Pyrometer Instrument Co., The 224

Radium Chemical Co., Inc. 201
Ransohoff, N., Inc. 68
Reading Chain & Block Corp. 195
Republic Steel Corp. 81
Robeson Process Co. 232
Royer Foundry & Machine Co. 13
Ruemelin Mfg. Co. 190

Safety Grinding Wheel and Machine Co., The 44
St. Louis Button Co. 232
Schneible, Claude B., Co. 75
Schramm, Inc. 165
Schundler, F. E., & Co., Inc. 191
Scientific Cast Products Corp., The 230
Scully Machinery & Equipment Corp. 237
Sight Feed Generator Co., The 220
Simonds Worden White Co. 184
Simplicity Engineering Co. 178
Sly, W. W., Mfg. Co., The 143
Smillie, C. M., & Co. 218
Smith & Richardson Mfg. Co. 214
Smith, Werner G., Co., The 4, 5
Smooth-On Manufacturing Co. 227
SPO, Inc. 157
Standard Conveyor Co. 167
Standard Horse Nail Corp. 149
Standard Silica Corp. 230
Steel Conversion & Supply Co. 210
Steel Shot & Grit Co. 223
Sterling Grinding Wheel Division of the Cleveland Quarries Co. 176
Sterling Wheelbarrow Co. 52
Stevens, Frederic B., Inc. ..... Inside Back Cover
Strand, N. A., and Co. 193
Stroman Furnace & Engineering Co. 79
Swan-Finch Oil Corp. 28
Swindell-Dressler Corp. 54

Tabor Manufacturing Co., The 90
Tamms Silica Co. 194
Tannewitz Works, The 183
Taylor, Chas., Sons Co., The 213
Thomas & Proetz Lumber Co. 228
Thomas Truck & Caster Co. 223
Titanium Alloy Mfg. Co. 86
Truscon Steel Co. 209

Union Carbide & Carbon Corp. 39, 55
United Compound Co. 209
United Oil Mfg. Co. 51
United States Electrical Tool Co., The 15
U. S. Steel Corporation and Subsidiaries 203
U. S. Steel Export Co. 203

Velsicol Corp. 146
Vonnegut Moulder Corp. 168

Wadsworth Core Machine and Equipment Co., The 223
Wall Chemicals Division of The Liquid Carbonic Corp. 229
Wellman Engineering Co., The 226
West Co., The 219
Western Tool & Mfg. Co., The 224, 232
Whiting Corp. 59
Wickland, A. A., & Co. 226
Woodward Iron Co. 123
Wrigley, Wm., Jr., Co. 186

Young Brothers Co. 38

Table of Contents, Page 3

Refer to alphabetical list of products in "Where-to-Buy" pages, beginning on Page 198

Classified Advertisers, Pages 234, 235, 236, 237

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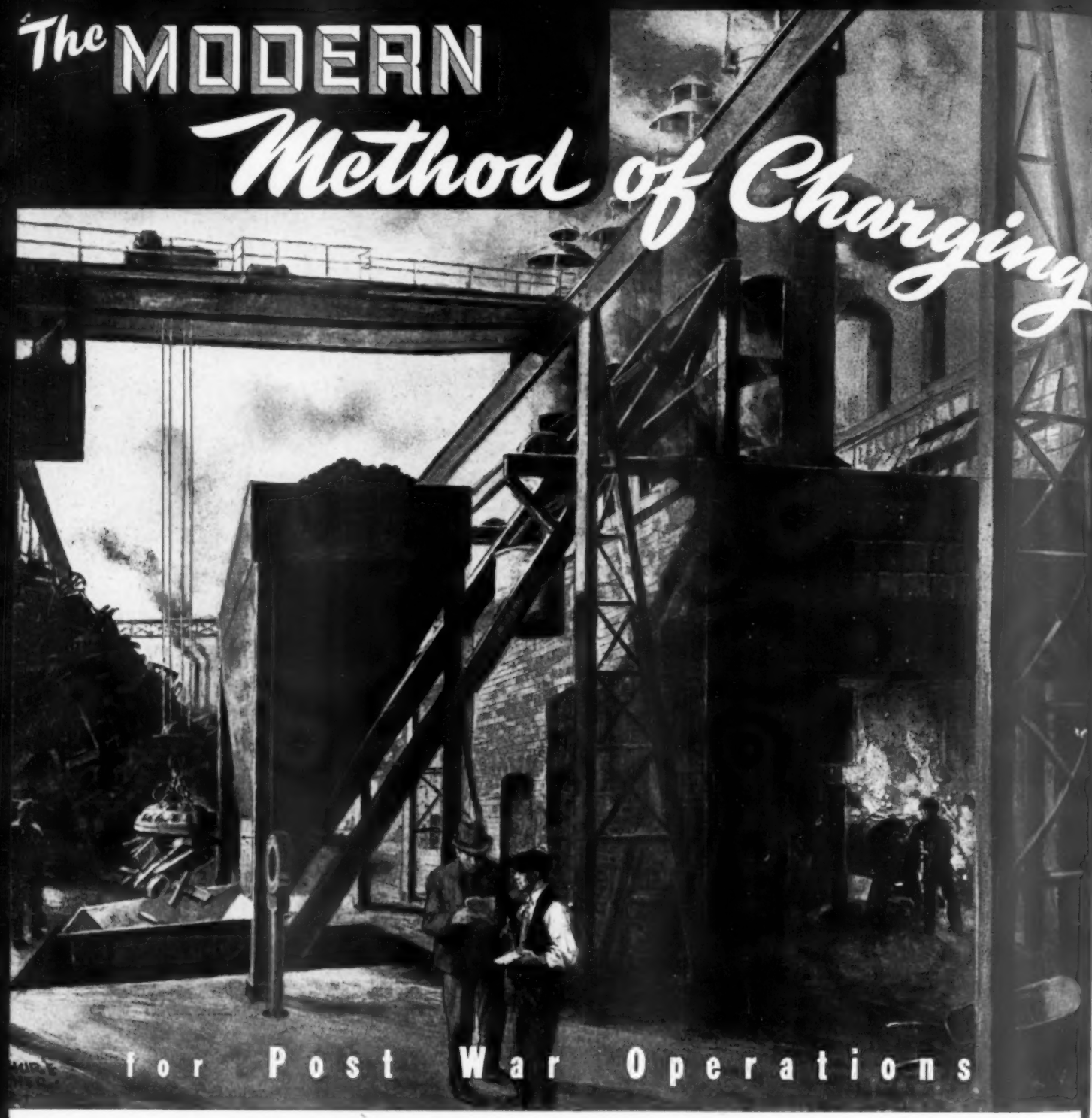

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with

NO SEAMS ★ NO WELDS NO RIVETS

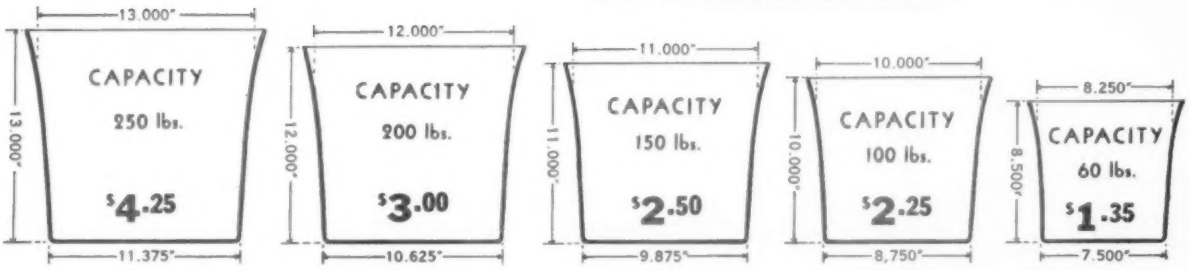
- ★ Every one of these ladle bowls is deep-drawn from a single sheet of SPECIAL ANALYSIS EXTRA HEAVY STEEL.
- ★ They are uniform in shape and size.
- ★ No weak joints which could open quickly.

★ The first cost is no more than that of ordinary ladle bowls. The ultimate cost is MUCH LESS.

★ Thousands of these ladle bowls are used daily in foundries all over the country and, the continuous flow of repeat orders we receive is mute testimony of their dependability.

★ There are no other ladle bowls made that give so much value for the foundryman's dollar.

STEVENS LADLE LINERS—custom-built to fit these bowls—eliminate hand daubing—give long life—insure cleaner metal.



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ASSIST MASS PRODUCTION
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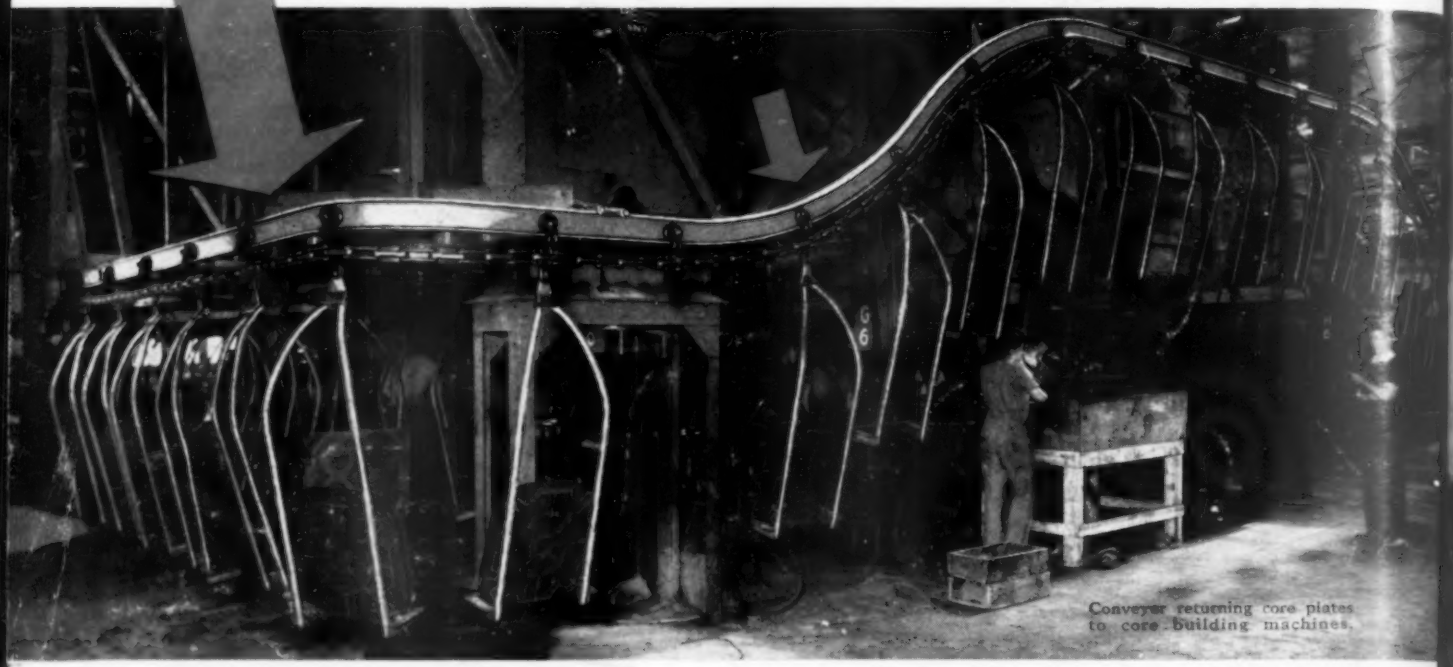

Conveyor returning core plates to core building machines.

● More than 5000 ft. of Link-Belt Overhead Trolley Conveyors, in their Benton Harbor, Mich. plant, eliminate lost motion and keep production "on the move." Handling core plates to the core makers; cores from the drying ovens and direct to the assembly of molds; and castings from annealing furnaces through monitor to cool and to the shot blast, is performed by this modern overhead trolley conveyor system.

In foundries Link-Belt Trolley Conveyor has unlimited possibilities for handling castings, cores, and in many cases the mold. Supported from overhead, it saves floor space, makes ceilings or roof trusses pay dividends, and travels irregular paths at predetermined speeds to meet production requirements. Simple, inexpensive and easily installed around existing equipment, readily altered, requires little power to operate and practically no maintenance.

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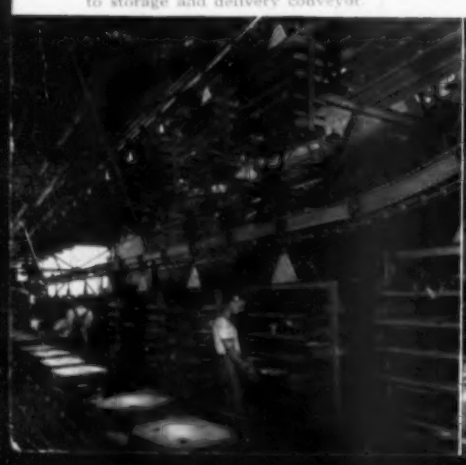
OVERHEAD TROLLEY CONVEYORS



Finished cores being transferred to storage and delivery conveyor.

Casting cooling conveyors located in roof monitors.

Conveying finished cores to mold assembly lines.